ENGINEERING NEWS-RECORD

A McGRAW-HILL PUBLICATION

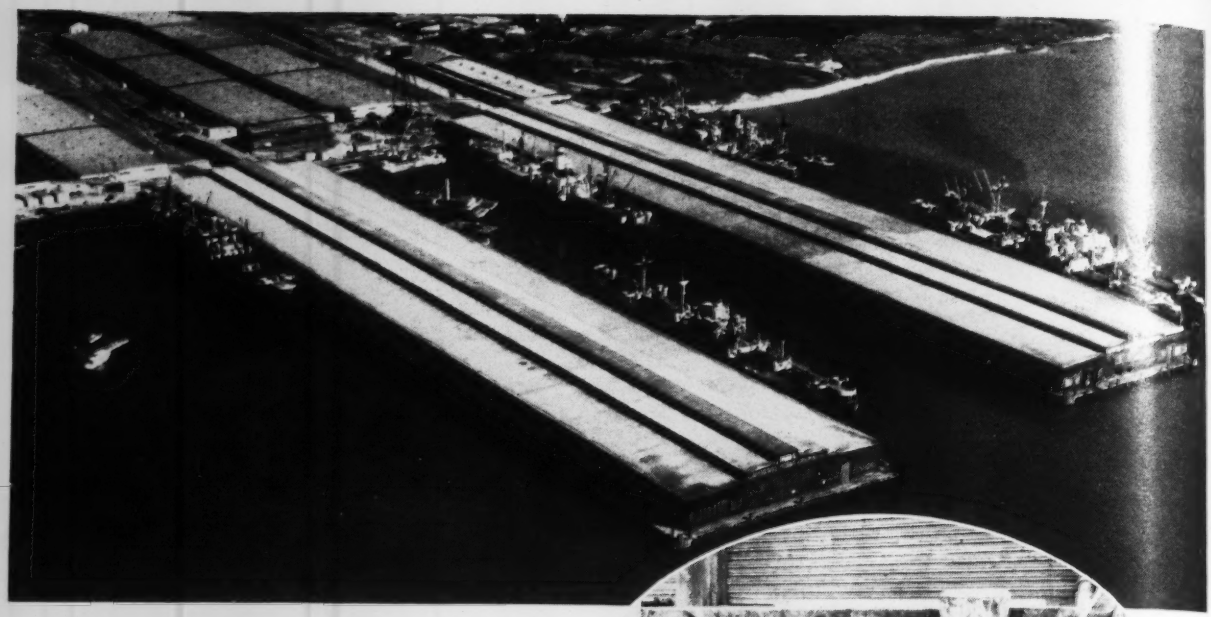
AUGUST 7, 1947

Precast concrete members fabricated in an existing precasting plant form the structural frame for a 210-ft. addition to the plant.

PRECAST FRAMING USED FOR TWO-STORY ADDITION AT [illegible]

NEW LINE BUILT TO RAISE RAILROAD ABOVE [illegible]

NATIVAK RESERVOIR ROOF REPLACED WITH [illegible]



Dropping the WROUGHT IRON CURTAIN on a fire hazard

Fire is a major hazard to piers, with the greatest danger in below-deck blazes. Such conflagrations virtually destroyed two large piers in 1945. In both cases the flames spread almost the full length of the pier before breaking through at floor level.

To safeguard its "L" and "S" piers at Lambert Point, Va., the Norfolk and Western Railway used a proven method . . . fire curtains of Byers Wrought Iron. At 300-foot intervals along the length of the pier parallel curtains were installed about 10 feet apart. Plates were notched to clear joists and stringers with clearances held to a maximum of ¼-inch, were flush with the flooring, and were attached, with 4-inch clearance, to the outside of parallel rows of piles with ¾-inch wrought iron bolts. The ends of each chamber were closed off with additional plates, forming a virtually sealed compartment, topped with a 9-inch concrete slab, a 3-inch layer of cinder concrete, and finally a 3-inch oak floor. Both faces of each double-curtain fire wall are protected by open sprinkler heads, manually operated, to hold plate temperatures down, and also to protect the flooring.

The use of wrought iron for this service is dictated by the severe corrosive conditions that exist. Wrought iron has been applied in firewalls for years, and its endurance has been repeatedly demonstrated. The unique structure of the material—tiny fibers of glass-like silicate slag threaded through the body of high-purity iron—halt and disperse corrosive attack, and discourage pitting. The fibers also anchor the initial protective scale, which shields the underlying metal.

Our bulletin, "Wrought Iron for Bridge Construction," illustrates and describes the application of wrought iron in this and similar services. We will be glad to send you a complimentary copy.

A. M. Byers Co., Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Atlanta, Chicago, St. Louis, Houston, Salt Lake City, Seattle, San Francisco. Export Division: New York, N. Y.

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ENGINEERING NEWS-RECORD

Devoted to Buildings, Sewerage, Waterworks, Bridges, Roads, Dams, Foundations, Earthwork, Flood Control, Public Works, Airports, Irrigation, Canals, Tunnels, Railroads

Volume 139 • Number 6

AUGUST 7, 1947

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FEATURES IN THIS ISSUE

News of the Week..... 53

Editorials 62

Railroad Relocated Above Conemaugh Dam..... 64

Kanawha Boulevard Extended at Charleston..... 69

Precast Concrete Frame Erected Like Structural Steel..... 72

Water Supply Connection Made With Minimum Shutdown..... 74

Reservoir Roof Replaced With Prestressed Dome..... 75

Activated-Sludge Plant Replaces Imhoff Tank.....E. R. SCHOFIELD 80

Terrace Plaza Hotel..... 84

Calyx Holes 1,400 ft. Deep Sunk for Hydro Project..... 88

Repairing Unlined Portions of Tunnel..... 90

Joints in Pavement Sealed by Truck Mounted Rig..... 92

DEPARTMENTS

Construction Trends..... 47

Comment and Discussion..... 93

Book Notes and Reviews..... 95

Material Prices..... 98

New Aids 104

Men and Jobs..... 114

Elections and Activities..... 118

Manufacturers' Activities 126

Manufacturers' Publications..... 134

Construction Reports..... 179

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308 W. Washington St., Chicago 6, Ill.

In the May 15th issue of Engineering News-Record our advertisement incorrectly stated. "Only Western drives Compressed Concrete Piles."

Construction Trends

Roundup of Construction Costs in the First Half of 1947

Engineering News-Record's construction and building cost indexes showed a rise of 11 and 4 points, respectively, from April to July of this year as the result of new construction and building wage agreements which were negotiated during this period. These increases, however, are smaller than in the January-April period, when the construction cost index rose 14 points and the building cost index, 12 points.

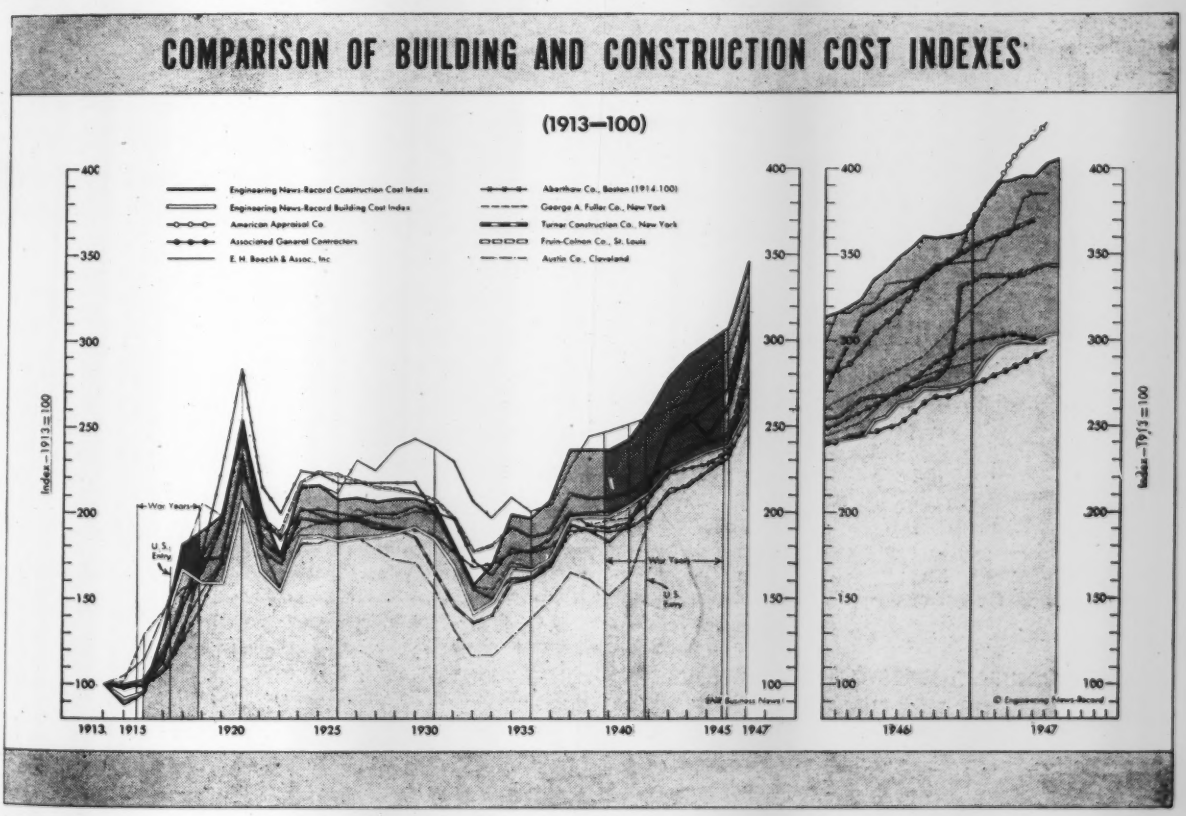
The increases in the early part of the year were the result of material price rises following the lifting of OPA ceilings in November, as well as wage increases. The July construction cost index, on the basis of 1913 as 100, of 407 was 7 percent above the January index, while the July building cost index of 305 showed a gain of 6 percent.

Other weighted indexes have also reflected the material price rises and wage increases, with the American Appraisal index rising 46 points from January to June of this year, the E. H. Boeckh index rising 39 points and the Associated General Contractors index, 17 points.

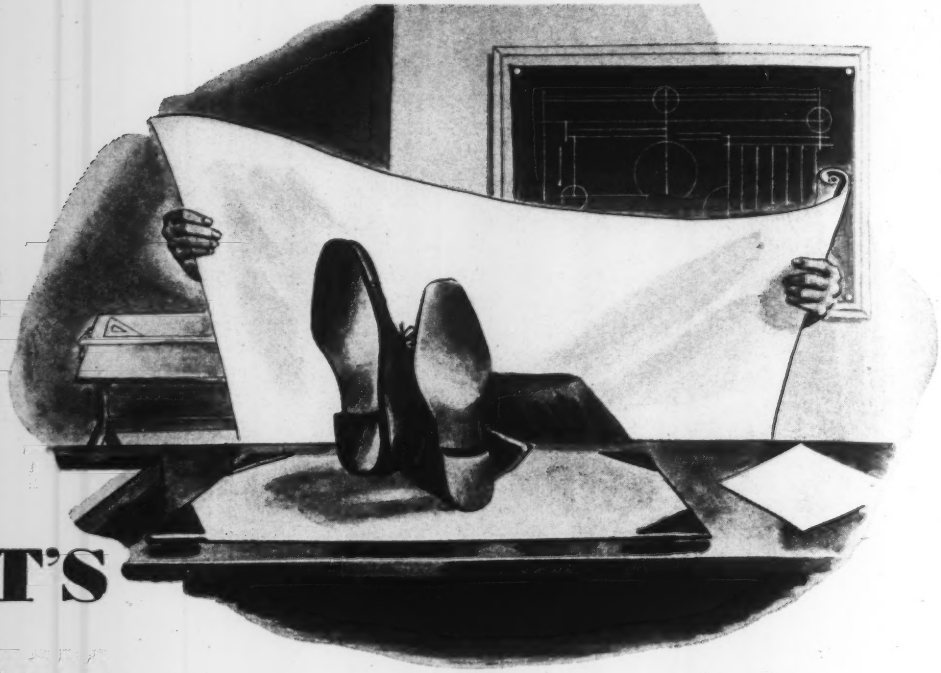
Contractor indexes, which include "hidden" cost elements, such as overtime wage payments, low productivity, material and labor shortages and other job delays, showed smaller gains in the first half of 1947 than the weighted indexes. The Austin index rose 11 points through June, the Fruin-Colnon index rose 6 points, while the Aberthaw index in June dropped back to the December level, after rising 4 points in the first quarter of 1947. The latest Turner index, which was for May, 1947, showed a rise of 14 points during the first 5 months of 1947.

HISTORICAL RECORD OF CONSTRUCTION COST INDEXES

	June 1946	July 1946	Aug. 1946	Sept. 1946	Oct. 1946	Nov. 1946	Dec. 1946	Jan. 1947	Feb. 1947	Mar. 1947	Apr. 1947	May 1947	June 1947	July 1947
WEIGHTED INDEXES														
ENR Construction	349	355	361	360	361	362	368	382	391	392	396	396	403	407
ENR Building	265	267	272	272	273	274	279	289	298	299	301	300	303	305
American Appraisal	317	326	335	342	347	352	371	381	390	404	414	419	427	...
Associated General Contractors	251	258	263	267	267	270	275	277	280	282	286	290	294	...
E. H. Boeckh	334	335	337	343	343	344	346	346	360	362	383	385	385	...
CONTRACTOR INDEXES														
Aberthaw	270	...	...	287	...	...	300	...	...	304	...	...	300	...
George A. Fuller	...	...	290	...	...	...	...	...	...	...	340	...	...	...
Turner	...	...	...	...	...	...	357	...	...	...	...	371	...	...
Fruin-Colnan	276	280	282	284	293	331	333	338	338	338	338	342	344	344
Austin	272	...	...	281	...	...	287	...	...	298	...	...	298	...



IF WE WERE IN YOUR CLIENT'S SHOES...



• here are some of the things we'd want in a chlorinator:

FLEXIBILITY—so that the chlorinator installed today would be adaptable to future changes.

LONG LIFE—to give us full value from our investment.

DEPENDABILITY—for positive, unfailing protection.

SIMPLICITY—so that the operator need not be a "gadgeteer" to keep it working.

LOW MAINTENANCE—in keeping with the economies of good management.

ADEQUATE SERVICE FACILITIES—to give us prompt, efficient service whenever needed for inspection or adjustment.

SOUND ENGINEERING—resulting in proved and workmanlike designs and installations.

A MANUFACTURER WITH EXPERIENCE—to back up his recommendations and insure a job-engineered installation to meet our particular needs.

AND THOSE ARE THE THINGS YOU'LL FIND IN EVERY W & T CHLORINATOR—from small Hypochlorinators for ounces of chlorine per day to Master Visible Vacuum Chlorinators of 6,000 pounds per day capacity.

Your W & T Representative will always be glad to give you details on equipment to meet *any* chlorination problem.

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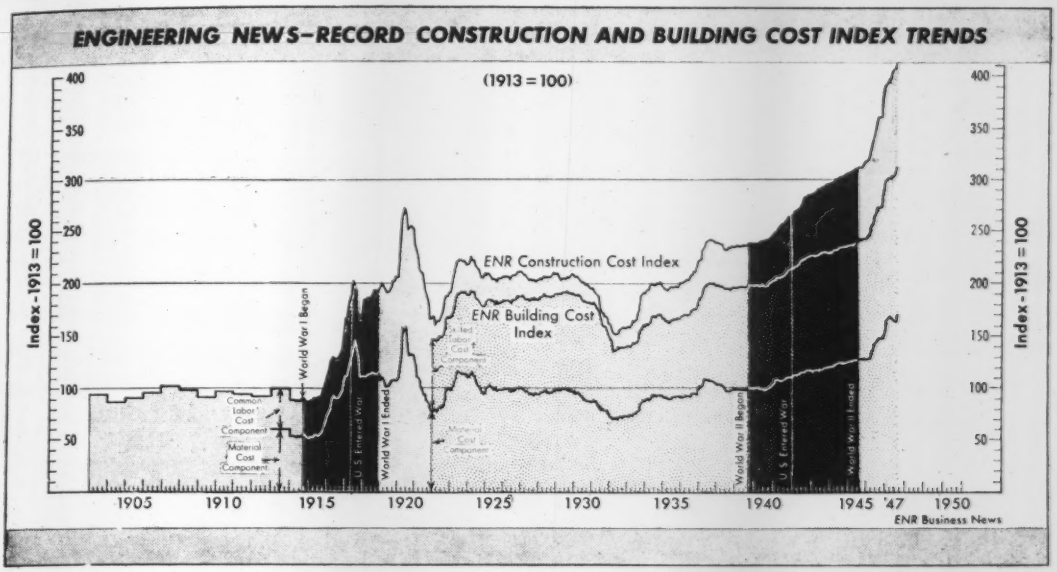
S-9

AUGUST CONSTRUCTION BUSINESS REPORT

ENGINEERING NEWS-RECORD CONSTRUCTION AND BUILDING COST INDEX TRENDS



ENR CONSTRUCTION VOLUME AND NEW PRODUCTIVE CAPITAL

Thousands of Dollars (,000 omitted)	July 1946 (4 wk.)	July 1947 (5 wk.)	% Change †	Seven Months 1946 (30 wk.)	Seven Months 1947 (31 wk.)	% Change †
Total U. S. Construction	$512,330*	$524,238	−18	$3,144,516*	$3,198,103	−2
Private Construction	236,734	253,321	−14	1,915,473	1,795,756	−9
Public Construction	275,596*	270,917	−21	1,229,043*	1,402,347	+10
Federal	135,549*	76,737	−55	449,251*	408,675	−47
E N R Construction Volume Index, 1913 = 100	311*	222	−29	271*	226	−17
Total New Productive Capital	1,810,047	315,961	−86	2,477,445	1,205,206	−53
Private Investment	245,199	315,961	+3	754,277	1,205,206	+56
Federal (non-federal work)	225,000	.....	.....	225,000	.....	.....
Federal (federal work)	1,339,848	.....	.....	1,498,168	.....	.....

* *Adjusted for cancellation of $24,264,000 contract in July.*
† *Adjusted for difference in the number of weeks reported.*

CONSTRUCTION COST .... WAGES RATES .... MATERIAL PRICES

1913 = 100	August 1946	August 1947	% Change	Change July to August 1946 July	1946 Aug.	%	Change July to August 1947 July	1947 Aug.	%
E N R Constr. Cost Index†	361.37	415.00	+14.84	354.70	361.37	+1.88	406.52	415.00	+2.09
E N R Building Cost Index†	272.29	313.03	+14.96	267.25	272.29	+1.89	304.87	313.03	+2.68

† *Does not reflect increased costs due to overtime, lower labor efficiency, delivery delays, etc.*

ENR 20-CITIES' AVERAGE

Common Labor	$1.071	$1.221	+14.01	$1.058	$1.071	+1.23	$1.217	$1.221	+0.33
Skilled Labor (Av. 3 Trades)	1.829	2.080	+13.73	1.816	1.829	+0.72	2.073	2.080	+0.34
Bricklayers	1.961	2.227	+13.52	1.941	1.961	+1.03	2.215	2.227	+0.54
Structural Ironworkers	1.825	2.078	+13.86	1.825	1.825	0.0	2.066	2.078	+0.58
Carpenters	1.706	1.938	+13.60	1.688	1.706	+1.07	1.938	1.938	0.0
Cement, per barrel	2.24	2.41	+7.59	2.22	2.24	+0.90	2.41	2.41	0.0
Reinforcing Steel, cwt*	3.338	3.983	+19.32	3.314	3.338	+0.72	3.946	3.983	+0.94
Structural Steel, base	2.35	2.80	+19.15	2.35	2.35	0.0	2.50	2.80	+12.00
Sand, per ton	1.499	1.797	+19.88	1.405	1.499	+6.69	1.786	1.797	+0.62
Lumber, 2x4 Fir, per M ft.	68.925	87.05	+26.30	67.847	68.925	+1.59	86.38	87.05	+0.78
Lumber, 2x4 Pine, per M ft.	67.181	77.78	+15.78	60.90	67.181	+10.31	77.51	77.78	+0.35
Common brick, per M	21.700	23.175	+6.80	21.125	21.700	+2.72	22.925	23.175	+1.09
Ready-mixed concrete, c.y.	8.242	8.987	+9.04	8.071	8.242	+2.12	8.934	8.987	+0.59
Struct. clay tile, 3x12x12	98.229	114.76	+16.83	94.627	98.229	+3.81	114.760	114.760	0.0

* *Except for New York, August prices average does not include recent increases.*

MATERIAL SHIPMENTS .... BUILDING PERMITS

	July 1946	July 1947	% Change	June 1947	% Change June to July
Steel (% operating Capacity) A.I.S.I.	88.4	86.0	−3	96.3	−11

	May 1946	May 1947	% Change	Five Months 1946	Five Months 1947	% Change
Cement, thous. bbl. U.S.B. of Mines	16,083	15,328	−5	59,414	59,704	+0.5

	June 1946	June 1947	% Change	Six Months 1946	Six Months 1947	% Change
Fabricated Structural Steel, tons, A.I.S.C.	126,850	133,024	+5	647,865	825,413	+27
Building Permits, 215 Cities, Dun & Bradstreet (,000 Omitted)	$192,785	$280,579	+46	$1,485,515	$1,282,782	−14

COST OF LIVING INDEX .... EMPLOYMENT

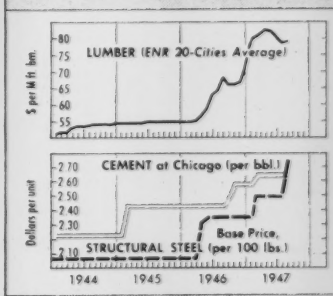
	May 1946	May 1947	% Change	April 1947	% Change April to May
Consumers' Price Index, B L S	131.7	155.8	+18.3	156.1	−0.2
Rent (Housing) Index, B L S	108.4	109.2	+ 0.7	109.0	+0.2

	July 1946	July 1947	% Change	June 1947	% Change June to July
Constr. Employment (est.), thous., B L S	2,182	2,144	−1.7	2,005	+6.9
Private Constr. Employ. (est.), thous., B L S.	2,022	1,665	−17.7	1,569	+6.1

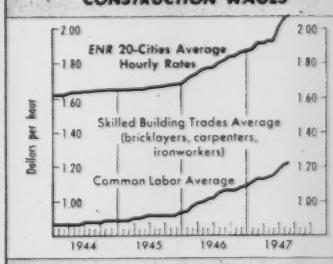
ENR INDEX NUMBERS

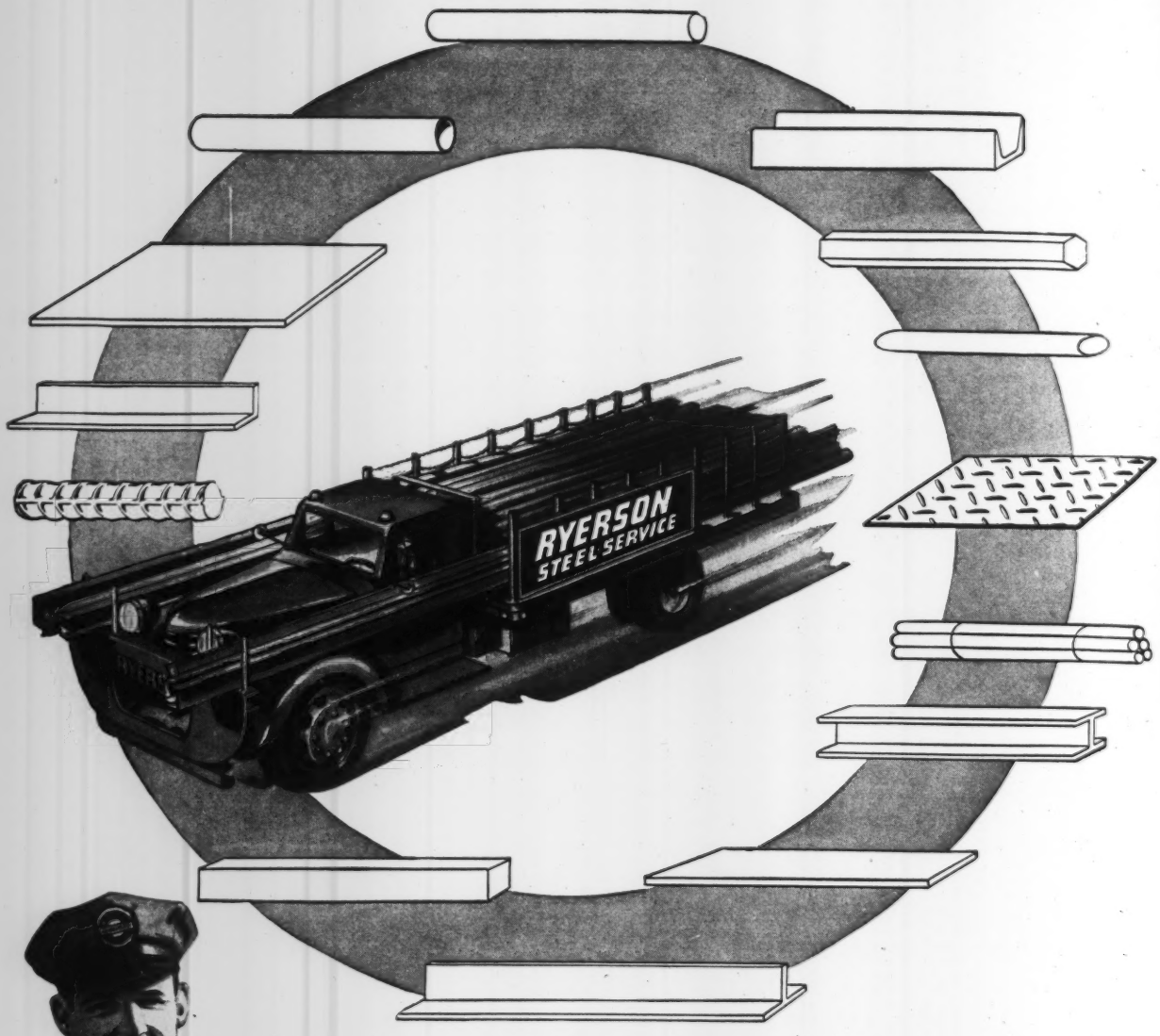
Base = 100	Construction Cost 1913	Construction Cost 1926	Building Cost 1913	Building Cost 1926	Volume '13	Volume '26
Aug., 1947	415.00	199.49	313.03	169.21	...	...
July, 1947	406.52	195.41	304.87	164.80	222	97
June, 1947	403.29	193.86	303.14	163.87	276	121
May, 1947	396.49	190.59	299.61	161.96	224	98
Apr., 1947	396.09	190.40	300.81	162.61	247	108
Mar., 1947	391.95	188.41	298.84	161.54	220	96
Feb., 1947	390.76	187.84	297.65	160.90	197	86
Jan., 1947	381.68	183.47	289.05	156.25	195	85
Dec., 1946	368.10	176.95	278.77	150.69	207	91
Nov., 1946	362.47	174.24	273.99	148.11	164	72
Oct., 1946	360.94	173.50	273.01	147.58	233	102
Sept., 1946	360.19	173.14	272.37	147.23	223	98
Aug., 1946	361.37	173.71	272.29	147.19	258	113
July, 1946	354.70	170.50	267.25	144.47	311	136
1946 (Av.)	345.94	166.29	262.25	141.76	248	109
1945 (Av.)	307.75	147.93	239.14	129.27	123	54
1944 (Av.)	298.72	143.59	234.73	126.89	96	42
1943 (Av.)	289.95	139.38	228.75	123.66	176	77

MATERIAL COST PRICES



CONSTRUCTION WAGES





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RYERSON STEEL

New Construction Volume in July

Civil engineering construction volume in continental United States totals $524,238,000 for July, an average of $104,848,000 for each of the five weeks of the month. This average is 19 percent below the June average, and 18 percent below the average of July, 1946, according to *ENR*.

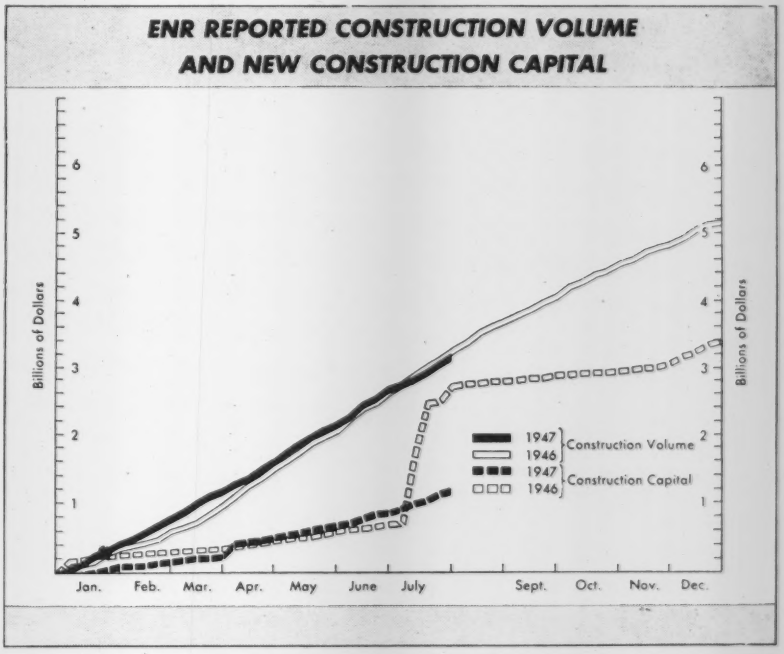
Private construction for July on a weekly average basis is 20 percent below last month and 14 percent smaller than July, 1946. Public construction is 18 percent below last month and 21 percent below last July. State and municipal construction is 3 percent below last month, but 11 percent above the average for July, 1946. Federal construction, down 42 percent from last month, is 55 percent below July, 1946.

Weekly averages in the various classes of construction for July, 1947 compared with June, show gains in industrial buildings of 48 percent; waterworks, 47 percent; and public buildings, 39 percent; losses in private bridges, 100 percent; private unclassified, 61 percent; public unclassified, 52 percent; sewerage, 51 percent; earthwork and drainage, 48 percent; commercial buildings, 28 percent; highways, 10 percent; and public bridges 9 percent. The July weekly average of industrial building rose above a year ago for the first time in 1947.

Geographically, five sections showed losses in July, 1947 over June —West of the Mississippi, 30 percent; Far West, 26 percent; Middle Atlantic, 17 percent; South, 14 percent; and Middle West, 6 percent. New England rose 11 percent over June.

Three sections made gains in July over July, 1946—South, 15 percent; Middle Atlantic, 3 percent; and Middle West, 1 percent. Far West dropped 58 percent below last year; West of the Mississippi, 25 percent; and New England, 12 percent.

New capital for construction for the five weeks of July, 1947 totals $315,961,000, or a weekly average of $63,192,000. This was 28 percent above the June '47 average and 3 percent above the July '46 average, exclusive of new federal appropriations.



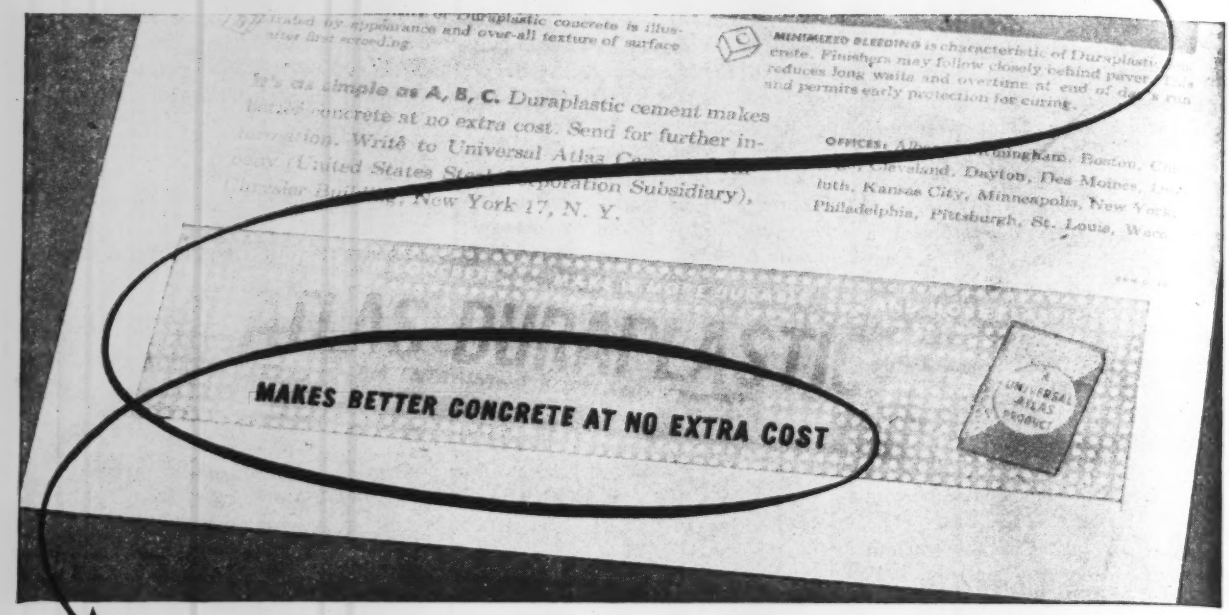
ENGINEERING CONSTRUCTION CONTRACTS REPORTED TO ENGINEERING NEWS-RECORD—JULY, 1947

Engineering News-Record *reports continental U. S. Construction projects of the following minimum costs — Waterworks, excavation, drainage and irrigation,* $22,500; *other public works,* $40,000; *industrial buildings,* $55,000; *other buildings,* $205,000

Five Weeks — Thousands of Dollars (000 Omitted)

	New England	Middle Atlantic	South	Mid-West	West of Mississippi	Far West	United States July 1947	United States Seven Months 1947	United States Seven Months 1946	Canada
Public Works										
Waterworks	55	254	1,900	3,385	975	3,469	10,038	65,665	56,300	981
Sewerage	353	1,379	2,818	3,695	1,870	2,127	12,242	76,413	57,837	525
Bridges, public	1,506	2,346	2,871	3,914	6,774	2,349	19,760	100,862	74,480	717
Earthwork and waterways	225	12,127	5,294	1,430	6,035	8,658	33,769	190,709	270,581	16,348
Streets and roads	2,411	12,242	25,417	18,142	26,889	11,142	96,243	474,428	449,661	9,822
Buildings, public	1,223	14,045	11,362	11,730	16,338	18,587	73,285	325,704	227,376	5,485
Unclassified, public	600	9,270	3,276	2,509	4,798	5,127	25,580	168,566	117,072	627
Total public	6,373	51,663	52,938	44,805	63,679	51,459	270,917	1,402,347	1,253,307	34,505
Federal government (included in above classifications)	493	14,487	10,692	9,951	15,487	25,627	76,737	408,675	473,515	.....
Private										
Bridges, private	.....	.....	.....	.....	.....	.....	.....	684	1,471	.....
Industrial buildings	2,950	14,428	35,651	17,501	17,054	4,522	92,106	480,735	596,895	5,388
Commercial buildings	7,525	69,849	20,273	9,705	22,219	8,236	137,807	1,049,975	1,199,919	16,855
Unclassified, private	40	2,666	4,975	480	11,287	3,960	23,408	264,362	117,188	4,720
Total private	10,515	86,943	60,899	27,686	50,560	16,718	253,321	1,795,756	1,915,473	26,963
Total Engineering Construction:										
July 1947 — 5 weeks	16,888	138,606	113,837	72,491	114,239	68,177	524,238	.....	.....	61,468
June, 1947 — 4 weeks	12,208	132,926	106,495	61,770	130,023	73,753	517,175	.....	.....	45,346
July, 1946 — 4 weeks	15,274	107,847	79,068	57,388	146,014	131,003	536,594	.....	.....	26,793
Seven months — 1947	121,357	805,238	581,146	425,005	730,982	534,375	.....	3,198,103	.....	280,084
Seven months — 1946	175,322	708,295	419,499	366,728	680,766	818,170	.....	.....	3,168,780	192,332

What's behind this fact . . .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News of the Week

ENGINEERING NEWS-RECORD • AUGUST 7, 1947 • VOLUME 139 • NUMBER 6

PRA approves 40,000-mile national highway system

State highway engineers, Public Roads Administration complete two-year study of Federal-aid road plans with recommendations for interstate road system

Based upon recommendations of the state highway departments, a 40,000-mile National System of Interstate Highways has been approved by the Public Roads Administration of the Federal Works Agency. The new system comprises the most heavily traveled highways in the present federal-aid system, including extensions of the system through urban areas.

A tentative selection of routes recommended for the interstate system was completed in 1945. Since that time, state highway engineers and the PRA have been engaged in reviewing the states' recommendations and ironing out differences concerning alternate routes and connections at state boundaries. All roads made a part of the system will receive favored attention for improvement by the states and PRA, but this does not mean that all federal-aid highway funds must be spent on the system.

The integrated system, as approved by PRA, consists of several transcontinental routes running east and west and a number of north-south routes, with numerous connecting links traversing the various states. The system contains 37,681 miles of the nation's principal highways, including 2,882 miles of urban thoroughfares. Urban circumferential and distributing routes are to be designated later, 2,319 miles of the system being reserved for these routes.

Connects major cities

Principal cities of the U. S. are to be connected by the system. However, the exact locations of the roads are left for future determination as improvement projects are planned. The system reaches 42 state capital cities and it will serve directly 182 of the 199 U. S. cities having a population of 50,000 or over.

Rural sections of the network comprise only 1.1 percent of all rural roads in the country but these routes carry about 20 percent of all the traffic on rural roads.

System follows 1944 road act

All routes on the network were selected in accordance with the Federal-Aid Highway Act of 1944. That law required that "there shall be designated in the continental United States a national system of interstate highways not exceeding 40,000 miles in extent, so located as to connect by routes as direct as practicable the principal metropolitan areas, cities and industrial centers, to serve the national defense and to connect at suitable border points with routes of continental importance in the Dominion of Canada and the Republic of Mexico."

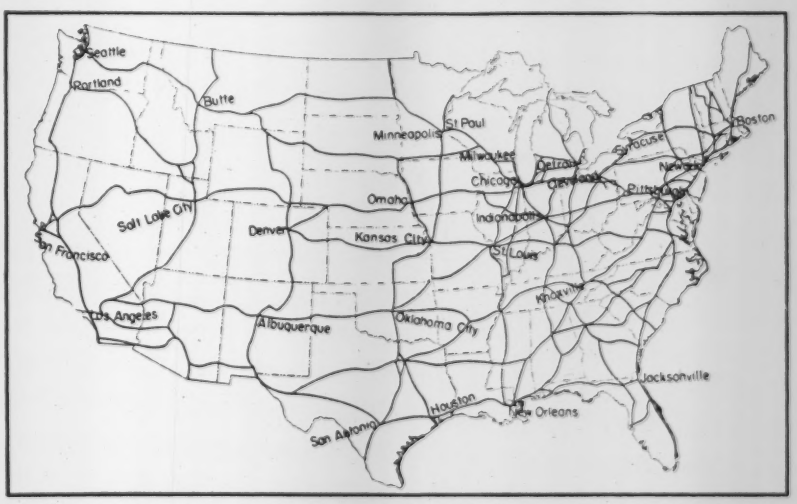
The 1944 act authorized Congress to appropriate $500,000,000 in each of the three fiscal years following the war to assist the states in developing a $3 billion highway program. This program would include improvements on the regular federal-aid system, on highways in urban areas where the population is 5,000 or more, and on a federal-aid system of secondary or farm-to-market roads.

Of the authorized annual appropriation for each year, $225,000,000 is earmarked for improvements on rural highways in the regular federal-aid system, while $125,000,000 is listed for highway projects in urban areas, including expressways, circumferential and distribution routes. The remaining $150,000,000 is earmarked for state systems of secondary roads.

No specific sum was provided for development of the national interstate system. However, since the system includes both rural and urban highways, the entire amount authorized for projects in urban areas and a portion of the funds assigned for improvements on rural sections of the federal-aid system can be expended on the national interstate system, within the limitations imposed by the act.

In most states where projects on the system are planned, one-half of the cost of actual construction and up to one-third of the cost of right-of-way will be financed by the federal government. An

(*Continued on page 54*)



Highway Network—Finally approved as the National System of Interstate Highways, the vast road network shown on the map will receive preferential treatment under provisions of the Federal Aid Highway Act of 1944.

NEWS IN BRIEF

In telegraphic form, here are latest news developments on the engineering and construction front during the week.

Construction—A new ocean-front hotel, the Delano, to cost $1,500,000 is to be built at *Miami Beach, Fla.* . . . Under way is a $1,527,000 measurement and analysis building to be built for the Army Air Forces at *Eglin Field, Fla.* . . . New buildings valued at $6,000,000 are being constructed for 14 church-supported colleges in *Minnesota.* . . . About $50,000,000 is to be spent in five years for hospital construction in Mississippi . . . In September, construction will start on three buildings to cost $1,750,000 at Kent State University, *Kent, Ohio* . . . *Richmond, Ind.*, churches are planning to spend $1,000,000 for new buildings in the next 10 years. . . . A $1,000,000 library is being built for the University of Alberta, *Edmonton* . . . Under way is a $10,835,000 modernization program for the A. E. Staley Mfg. Co. at *Decatur, Ill.* H. K. Ferguson Co. are the engineers and builders . . . Maryland has authorized $2,500,000 for schools in *Anne Arundel County* . . . A wholesale produce terminal to cover seven blocks and to cost $6,500,000 will be started shortly at *Philadelphia, Pa.* . . . Ground will be broken soon for a $7,000,000 plant for the Chrysler Corp. at *San Leandro, Calif.*

Highways—Georgia plans to let between $2,000,000 and $2,500,000 in road contracts each month for the next year . . . *St. Petersburg, Fla.*, will ask the Circuit Court to validate a $15,000,000 bond issue for a toll bridge and causeway across Lower Tampa Bay . . . Following the signing of a $3,000,000 negotiated contract with the Duval Engineering and Contracting Co., on the construction of the *Jacksonville-Fernandina, Fla.*, link of the new Highway 105 work is expected to start Sept. 1 . . . Gov. Val Peterson of *Nebraska* has named a 35-member citizen's committee to make a study of the state's highway needs . . . The $6,000,000 joint *Philadelphia-Pennsylvania* program to improve Roosevelt Boulevard will get under way within a month . . . Over $12,000,000 of new highway construction is expected to get under way in the state of *Arizona* within 6 months.

Housing—*Trenton, N. J.*, received a low bid of $968,700 for a 198-family apartment center for veterans . . . A $1,000,000 general contract has been let for an apartment development at *Wayne, Pa.* . . . Construction of a 276-unit apartment development on Lane Park Road, *Birmingham, Ala.*, is under way . . . A 350-unit apartment house costing $3,000,000 is planned for *Phoenix, Ariz.*

Sewers and water supply—*Logansport, Ind.*, will ask FWA for $50,000 for engineering fees for its proposed treatment and disposal plant . . . *Salem, Ohio*, wants to enlarge its storm sewer system, and *Warren, Ohio*, will submit a $1,950,000 bond issue to voters Nov. 4 to complete sewer work already started . . . *Rock prings, Wyo.*, is having an engineering report prepared by Robert L. Streeter, of Casper, for a treatment plant to cost about $300,000 . . . Plans and specifications for a proposed $125,000 intercepting sewer at *Decatur, Ind.*, will be ready this month . . . *Wabash, Ind.*, has failed for the third time to get a bid for construction of sanitary sewers because of legal complications over payment . . . Metropolitan District Water Bureau of *Hartford, Conn.*, will extend water service to the Pequonnock section of Windsor . . . William Smith, Inc., *Portland, Ore.*, contractor, has started work on intercepting sewers, first step in the city's proposed $12,000,000 sewage disposal project.

To sell $10 million bonds for Tacoma Narrows span

The Washington State Toll Bridge Authority has adopted a resolution calling for the sale of $10,000,000 in bonds to finance reconstruction of the Tacoma Narrows suspension bridge, which collapsed in 1940, and authorizing the state highway director to call for construction bids as soon as he deems advisable.

As soon as minor details, such as agreement upon insurance provisions, are worked out, the state will be in a position to sell the bonds without further official action, said Gov. Mon C. Wallgren. The call for construction bids is expected to follow sale of the bonds.

The Tacoma Narrows bridge will have an entirely new 4-lane superstructure consisting of a 2800-ft. main suspension span and two 100-ft. side suspension spans, according to C. E. Andrew, chief consulting engineer for the authority. The structural steel towers will be 40 ft. higher than towers on the original structure and will carry suspension cables of 21-in. diameter. Left from the old structure, main concrete piers and abutments will be modified above the water, anchorages enlarged and approaches rebuilt. Principal quantities include 32,000,000 lbs. of structural steel, 32,000,000 lbs of cable wire and 1,900,000 lbs. of reinforcing steel.

PRA approves 40,000-mile road net

(Continued from page 53)

exception is work in a state containing large areas of public land, in which case additional federal aid is provided.

Although the new interstate system follows, in general, the principal routes in the present federal-aid system, it may be necessary in many instances to relocate existing highways or build alternate routes for express traffic in order to eliminate hazardous curves and provide more direct connections between cities, Commissioner Thomas H. MacDonald of PRA reports.

Routes included in the system, as well as proposed standards of design and construction, conform in broad outline to recommendations contained in the report submitted to President Roosevelt in 1944 by the National Interregional Highway Committee, of which Commissioner MacDonald was chairman (*ENR* Jan. 27, 1944, vol. p. 144).

AASHO approves standards

The design standards, which were approved by the American Association of State Highway Officials on Aug. 1, 1945, (*ENR* Jan. 10, 1946, vol. p. 44) call for four-lane divided highways on sections of the interstate system where the present or anticipated hourly traffic volume is 800 motor vehicles in peak hours. For such highways, a right-of-way width of 250 ft. is advocated as desirable, and a minimum of 150 ft. is specified.

On sections of highways approaching large cities, where traffic volumes are considerably greater, six-lane divided highways with controlled-access features, are recommended. Where traffic density exceeds 3,000 vehicles in peak hours, elimination of all cross-traffic at grade is advocated. A minimum sight-distance of 600 ft. for passing also is recommended for two-lane highways, with much greater sight-distances being urged to permit passing on more heavily traveled roads.

Considerable construction has been started on improvements on sections of the federal-aid roads included in the national system. However, Commissioner MacDonald emphasizes that development of an entire system embodying standards of design recommended by the PRA and the AASHO is a long-range program.

Congressional actions summarized on non-appropriation engineering bills

Many measures remain on legislative calendar as congressmen take recess for the summer

In addition to approving appropriation and contract authorization bills totalling more than $1,894,000,000 (*ENR* July 31, vol. p. 145), Congress found time to approve several other bills of considerable importance to the construction industry before it adjourned. On some board proposals, however, little was done.

Approved measures that carry no construction money, with reference dates in *Engineering News Record*, include:

H. R. 1874, extending the time during which federal funds provided in the Federal Aid Highway Act of 1944 are available (July 3, vol. p. 14); S. 526, creating a foundation for research in pure science (July 31, vol. p. 162); S. 1628, (the Taft-Hartley bill) containing a definition of a "professional worker" and restricting activities of labor unions (June 5, vol. p. 903); H. R. 3215, placing sanitary engineers in both the Army and Navy in a subordinate position to medical personnel (June 12, vol. p. 919).

S. 1361, amending the housing act of 1937 to permit federal aid for low-rent housing where the construction costs exceed present cost limitations if the local housing agency pays the difference between the cost limitations and actual construction cost; Law 62, enlarging the Civil Engineer Corps of the Navy by 660 additional officers (April 24, vol. p. 708); H. R. 3203, extending rent control but wiping out virtually all federal restrictions on construction (July 10, vol. p. 23); H. R. 3541, defining the functions and duties of the U. S. Coast and Geodetic Survey and increasing the scope of this agency; H. R. 4168, removing the Institute of Inter-American Affairs from the State Department and making it a corporation with a life of at least three years; S. 1230, extending by $400,000,000 the authority of the National Housing Agency to insure mortages on new homes.

S. 1418, providing congressional approval for an interstate compact among New England states for stream pollution abatement. Passed Senate July 23 and was unexpectedly passed by the House on the last day.

Unfinished business

Many proposals failed of enactment, but it should be noted that when Congress reconvenes, work on these proposals can be continued where it was left off. The more important of these measures along with their progress are:

H. R. 3759, permitting the Public Roads Administration to use up to 3¾ percent of federal road funds for administrative purposes. Passed by the House but now pending before the Senate.

H. R. 3660, establishing a National Superhighway Commission and permitting surveys and studies for construction of a system of super-highways to be made. Bill has not been reported out of committee.

S. 800, authorizing appropriation of funds for construction of access roads to timber lands. Approved by the Senate and awaiting House action.

Requests for funds to continue work on the Inter-American Highway. No bills reported out of committee.

Dirksen slum clearance bill setting a broad pattern for this type of work and authorizing the Federal Works Agency to make grants and loans to states and local groups doing clearance work. Still awaits committee action.

Wagner-Ellender-Taft Housing bill (S. 866). Approved by Senate Banking Committee but still on Senate calendar. A recess study of the entire housing picture by a joint Senate-House committee is now starting.

Taft-Barkley stream pollution abatement bill (S. 418) approved by Senate public works committee and passed by Senate (*ENR* July 24, vol. p. 101). No action by house committee on companion measure.

Vandenberg bill, calling for completion of the St. Lawrence Seaway. Approved by Senate Foreign Relations Committee (*ENR* July 24, vol. p. 100) but not formally reported on Senate calendar prior to adjournment.

Mundt bill (H. R. 3342). Provides for international exchange of engineers and technicians. Passed House and approved by Senate Foreign Relations Committee (*ENR* May 15, vol. p. 793) but is still pending on Senate calendar.

H. R. 3314, authorizing $127,000,000 of Navy public works construction. Approved by House Public Works Committee but still pending on House calendar.

S. 1675 and S. 1676, authorizing but not appropriating $252,000,000 for War Department military construction. Approved by House committee (*ENR* July 3, vol. p. 22) but still on the calendar.

Brewster bill (S. 1038) channelling airport funds through state agencies. Approved by Senate Committee on Interstate and Foreign Commerce. Pending on Senate calendar.

Muhlenberg bill (H. R. 3490) providing FWA with $50,000,000 to help local agencies plan public works. Not out of committee.

H. R. 4083, authorizing a toll bridge or tunnel across Chesapeake Bay. Not reported out of committee.

Wolcott bill (H. R. 3492) speeding up disposition of surplus war housing. Passed the House and pending in Senate.

Other bills that failed were those calling for creation of valley authorities, including the Missouri Valley Authority and the Columbia River Authority, and the proposals that minimum wages be increased. Four bills (S. 443, S. 1175, H. R. 1598, and H. R. 1616) authorizing the construction of the Bridge Canyon Project to bring Colorado River water to central Arizona (*ENR* Feb. 27, vol. p. 335) also failed.

Canada to widen, deepen St. Lawrence

Canada has embarked on the final stage of its program for deepening and widening the St. Lawrence ship channel to provide a passage to Montreal for larger and faster cargo vessels.

The plan involves expenditure of $14,700,000 over a five-year period for dredging. The contract has been awarded to the Marine Industries Ltd.

The program is based on the report of an interdepartmental committee made last December but just released. The objective is to expand the facilities of river ports in the hope of diverting trade now going to the United States, but the timing coincides with plans for an international St. Lawrence Seaway development. The completed ship channel would be adequate for traffic resulting from the larger plan.

The plan calls for completion of a 342-mile channel 550 ft. wide and 35 ft. deep (on the basis of the 1934 low water mark) to extend from the foot of the Lachine Canal to Quebec and a channel 1,000 ft. wide from Quebec to Father Point.

The Montreal harbor basin itself would be deepened, and increased anchorage provided both in the harbor and in Lake St. Peter. It would allow easy and fast navigation of cargo ships and tankers up to 20,000 tons, 625 ft. in length and capable of speed of 20 knots.

Order creates new top housing agency

By executive order, effective July 27, the President has created a new permanent body to be known as the Housing and Home Financing Agency, combining the work of the several existing government housing agencies.

The President took this action in Reorganization Plan No. 3, which was published in the Federal Register of July 26. This proposal was disapproved by the House, but when the Senate voted favorably the plan became effective under the terms of the Reorganization Act of Dec. 20, 1945.

The new plan consolidates the functions of the Home Owner's Loan Corp., the Federal Savings and Loan Insurance Corp., the Federal Housing Administration, the United States Housing Authority, the Defense Homes Corporation and the Federal Home Loan Bank Board.

Three constituent agencies will make up the new body. These are to be known as: the Home Loan Bank Board, the Federal Housing Administration, and the Public Housing Administration.

Foley to head new agency

A single administrator will head the new overall agency, with Raymond M. Foley, head of the National Housing Agency—who has spent several years in public housing—expected to fill this job. He will be paid $10,000 yearly.

Two of the three new constituent agencies—the FHA and PHA—will each be headed by a commissioner appointed by the President with Senate consent. These men will receive $10,000 yearly. The Home Loan Bank Board will consist of three presidential appointees, also receiving $10,000. Appointments for these jobs are expected to be announced in the near future.

A National Housing Council is also created by the new plan. It will be composed of the administrator of the new top agency (or HHFA), who will serve as chairman, the commissioner of the FHA, the commissioner of PHA, the chairman of the Loan Bank Board, the administrator of Veterans' affairs, the chairman of the Reconstruction Finance Corp., and the Secretary of Agriculture.

It is to be noted that the Office of the Housing Expediter, now headed by Frank Creedon, is not involved in the reorganization. This agency is to expire Feb. 29, 1948, unless future legislation provides otherwise.

CAA now revising airport program

Faced with the necessity of cutting in half its proposed work on large airports, the Civil Aeronautics Administration will attempt to fit the program to the $23,500,000 appropriation granted for the current fiscal year—one-half of the amount originally requested—and to provide runways offering a greater margin of safety for 4-engine airplanes.

Scope of the revised plan, which will be disclosed later this month, will be determined to a great extent by the Presidential Safety Board's recommendations. In effect, the latter limits four-engine aircraft operation to runways 4,000 ft. or more in length.

Another possible factor in the restudying of the construction program is the runway classification according to use and weight of aircraft, suggested by CAA some time ago.

Pending re-determination of the program, CAA last week would not estimate the extent of the changes to be made in the plan announced early in the year to improve nearly 800 smaller airports in the continental U. S. at a cost of $70,000,000 (*ENR* Feb. 20, 1947, vol. p. 296). The new program probably will be primarily concerned with class IV and larger fields, although there was some indication that class III and smaller fields may be affected. CAA has tentatively allocated more than $30,000,000 for work on class III fields.

The program to improve class IV and larger fields was subject to Congressional approval. In May, when it became apparent that CAA would be given only one-half the funds it requested for class IV and larger fields, Secretary of Commerce W. Averell Harriman estimated that the reduction would eliminate one-half of the projects on the list and leave CAA with a backlog of grant-in-aid requests totaling $180,000,000. This estimate will be revised in CAA's present thorough-going re-study of the situation.

As of June 23, last date for which figures are available, there were 186 airports approved for operation of 4-engine equipment. Of these, only 77 were in use.

CAA originally proposed improvements at 135 of the 186 four-engine fields. Under the Harriman estimate, 58 of the 135 would be dropped from the program. Of the remaining 77, funds available for 28 would be reduced, and 49 would not be affected by the cut.

The critical nature of the runway situation can be illustrated by examining the 32 fields now in use for four-engine airplanes, but which have runways less than the sea level equivalent of 4,000 ft. There were 24 of these fields included in the original improvement program. On the basis of Harriman's statement nine of these would be dropped, nine more reduced in scope, with only six of the 32 unchanged. Three of those six are scheduled for improvement under the class III and smaller program, so would not be affected by the Congressional paring of the $70,000,000 request.

CONSTRUCTION LABOR ROUNDUP

Developments in the construction labor field last week, summarized briefly by Engineering News-Record correspondents, included:

Missouri—Governor Phil M. Donnelly signed the Madison bill to bar jurisdictional strikes, secondary boycotts and strikes against the government, the bill to become effective Sept. 10 . . . **Minnesota**—An agreement giving a wage increase of 23 cents an hour has been reached between contractors at Virginia, Minn., and the local carpenters' union after a meeting with the state conciliator. The new rate is $1.55 an hour . . . **Ohio**—A strike by 80 iron workers who ask a $3-a-day subsistence premium, caused some 140 workers in various trades to be laid off in Huron, Ohio. The majority of the strikers are from Cleveland, and seek the extra allowance to meet traveling expenses . . . **Kentucky**—Union bricklayers in Louisville have won demand for a 25-cents-an-hour wage raise . . . **Washington**—The Washington State Federation of Labor Building section has asked the state legislature to pass a bill requiring the licensing of building contractors . . . **New York**—A 20-cent-an-hour wage boost for laborers and hod-carriers in the southern counties of New York has been agreed upon by the Associated Building Contractors and Local 7 of the Hodcarriers, Building and Common Laborers' Union . . . **North Carolina**—Two North Carolina contractors, both at Asheville, have agreed to aid the Asheville Building Trades Council in its fight on the state anti-closed shop laws, by signing a contract incorporating the checkoff of union dues and the closed shop. The case will be brought before the state superior court . . . **Indiana**—Trustees of Indiana University have announced that with the approval of an agreement with building trades unions to maintain present wage rates, the University is ready to begin a $4,500,000 construction program.

Inter-American Institute is made corporation

Now awaiting the President's signature is a bill (H. R. 4168) that would make the Institute of Inter-American Affairs a corporation with a life of three years from the time the bill is made law. Work of the Inter-American Educational Foundation is assigned to the new corporation.

The Institute of Inter-American Affairs is a government-controlled, nonprofit, membership corporation organized under the laws of Delaware and created on March 31, 1942, under U. S. Public Law 353 passed in 1941. The educational foundation is a parallel corporation created Sept. 25, 1943. During the war the corporations operated effectively as independent bodies, but on May 20, 1946, by executive order 9710, control of both bodies was transferred to the State Department.

Within the new organization three divisions are planned. These are: health and sanitation, education, and food and nutrition.

Work under the sanitation division calls for continuation of the cooperative program with Bolivia, Brazil, Chile, Colombia, Dominican Republic, Ecuador, El Salvador, Guatemala, Haiti, Honduras, Mexico, Paraguay, Peru, Uruguay and Venezuela.

Arthur Harris is expected to continue as president of the new corporation. The health and sanitation work will be supervised by Clarence I. Sterling, Jr., who is now chief engineer and associate director of this division.

Civil engineer to head new Pullman Co.

Carroll R. Harding, assistant to the president of the Southern Pacific Company, and a prominent railroad engineer, has resigned and has been elected president of the reconstructed Pullman Company, following the transfer of the old company's properties to a group of 57 railroads.

Harding is probably best known for his work in connection with the Southern Pacific's Martinez bridge of which he was the engineer in charge of construction. Harding was graduated from Cornell University college of engineering with honors in 1910. After three years' service with the American Bridge Co. in Alaska, Michigan and Costa Rica, Harding joined the Southern Pacific in New York in 1913.

After several promotions, he came to San Francisco as engineer of standards in 1925.

MAN-MADE RAINSTORM NOT JUST BRAINSTORM

Man-made rain, forced out of the clouds by mechanical means, last week seemed to offer relief to water-hungry Arizona farms and industry.

On July 21 the Arizona *Republic* chartered a transport airliner to drop "dry ice" pellets on cumulus clouds in the Eastern Arizona sky and succeeded in precipitating thousands of tons of water in the watershed of Roosevelt Dam.

It was the first attempt to utilize in the arid desert a technique for precipitating moisture out of clouds developed only last winter by Vincent J. Schaefer, scientist of the General Electric Co. Schaefer's experiments concerned snow.

The newspaper says: "Visible results already accomplished suggest that there is available to Arizona, its water users and its power companies, a method of insuring that all available moisture is channeled into the reservoirs where it will be of most complete benefit."

Construction materials freight rate rise asked

The country's railroads, in requesting the Interstate Commerce Commission to sanction freight rate increases averaging 16 percent, have established a set of increase limitations for certain construction materials.

The petition proposes to increase rates on construction material as follows: cement, lime, and plaster, a maximum of six cents per 100 pounds; granite paving blocks and curbing, 30 cents per net ton; building woodwork and millwork, lumber, veneer and built-up wood, posts, poles, and piling, 12 cents per 100 pounds; sand and gravel, cinders, limestone, marl, slag, crushed stone, and oyster and clam shells, 20 cents per net ton; nails, spikes, staples, wire, and many iron and steel manufactured articles, seven cents per 100 pounds, not to exceed $1.40 per ton, net or gross, as rated.

California cement prices up

Northern California cement companies have posted price increases of 20 cents a barrel, raising prices to a $2.05-$2.20 range. The raise followed a similar price change announced late in May for purchasers located in southern California.

Permanente Cement Co., Santa Cruz Portland Cement Co. and Calaveras Cement Co. announced the new prices. Permanente also announced new export prices of $2.67 a barrel, f.o.b. mill, for South and Central America and the Orient.

Major expansion planned at Hanford atomic plant

"No details of design, construction or operation" of a big expansion program authorized for the Hanford atomic materials plant at Richland, Wash. will be made public, the U. S. Atomic Energy Commission has announced. "Full security restrictions" will be maintained for contractors and employes.

However, observers said, the proposed project will mean not only a major expansion at the Hanford project, with new chemical process plants, research facilities and improvements to production units, but enlargement of the town of Richland, residential area for Hanford workers.

Tennessee Chute work to start next year

Construction of the Tennessee Chute harbor project at Memphis, Tenn., will begin next spring, according to Maj. Gen. Robert W. Crawford, president of the Mississippi River Commission. First phase of the 3-year task will be closure of the head of Tennessee Chute by building an earthfill dam connecting President's Island to the Memphis shore line north of Riverside Park. An allocation of $750,000 for initiating the work on a continuing contract basis has been made. Bids will be called for by Col. Edwin P. Lock, Jr. Memphis district engineer probably next January and actual work will start as soon as spring low water conditions permit. The dam will require movement of more than half a billion cu.yd. of dirt to be obtained from river by hydraulic methods and dredges.

The San Diego aqueduct to be extended 16 miles

A contract for the construction of a 16-mile extension of the San Diego aqueduct to serve the La Mesa and Sweetwater districts has been awarded by the San Diego County Water Authority to the American Pipe and Construction Co. of Los Angeles on its low bid of $1,074,973, according to J. L. Burkholder, manager and chief engineer of the authority.

The branch line will tie into the aqueduct at the west portal of the San Vicente tunnel, a few miles north of Lakeside, and will run through Lakeside, Bostonia, Jamacha to the Sweetwater Reservoir. The extension will serve the Lakeside, the La Mesa and other irrigation districts.

States find highway work expensive

It now costs five one-half million dollars per mile to construct modern high speed highways in Pennsylvania it is disclosed by Ray F. Smock, State Secretary of Highways.

He said the first nine miles of the Penn Lincoln Highway in Pittsburgh will cost $50,000,000, which is only about one-eighteenth of the total $837,000,000 now foreseen as the cost of the highway network proposed for the state.

The Penn-Lincoln Parkway, as planned will be four to six lanes wide with lanes separated by medial divisors. There will be no intersections at grade, no traffic lights and access will be permitted only at pre-determined interchange points.

How the vast program is to be financed remains to be determined, the Secretary said. He asserted that in the next five years the state will have only about $360,000,000 for such construction .

N. C. spends $33 million

During the first six months of 1947, the North Carolina State Highway and Public Works Commission spent more than $33,000,000 for road construction and maintenance, according to Chairman A. H. Graham. Included was new construction, improvement of primary and secondary roads, and maintenance of the existing road system.

For the period from January through June, contracts for road work covering 891 miles and costing $17,936,932.75, including costs of engineering and obtaining rights-of-way, were let to private contractors. For the same period, state forces completed betterment work on 5,090 miles of roadway at a cost of $6,173,700, and 1,051.15 miles of bituminous work at a cost of $1,712,740. Maintenance work on all existing roads for the period cost the state an estimated $7,750,000, according to figures released by Chief Highway Engineer W. Vance Baise.

During the period, highway expenditures for contract work included $9,150,673.97 for bituminous surface treatment; $3,318,790.50 for sand-asphalt pavement; $2,219,000 for concrete pavement; and $1,335,805 for grading. Included in the contract work was an item of $549,827 for structures.

Arkansas road plans

Moving to put its trunk-line highways in good condition, Arkansas has launched a $62,000,000 repair and reconstruction program.

Primary traffic arteries crossing the state from northeast to southwest, from east to west and northwest from Little Rock, are undergoing extensive repairs. Repair work will total more than $18,000,000 with some 83 construction jobs under way.

At the same time, the state is participating in a $44,000,000 federal-aid program during the next two years, all of which will be for new construction.

BUILD ROADS WITH WAR EXPLOSIVES

J. A. Terteling & Sons, West Coast contractor, has purchased 474,480 lbs. of surplus demolition blocks from WAA and will use the army's enemy road-wrecking explosive for building new roads.

The demolition blocks are said to be 25 percent more effective than TNT and more than twice as powerful as dynamite in land clearing, excavating, ditching, quarrying and road construction.

C. R. McMillan heads S. C. road commission

The South Carolina State Highway Commission last week had named Chief Engineer C. R. McMillian as chief commissioner to replace former commissioner U. S. Williamson; and elevated District Engineer S. N. Pearman of Orangeburg to chief engineer.

C. R. McMillan

The action by the commission came on a vote of 11 to 3 to oust Mr. Williamson. No specific charges were made against him but Commissioner L. Banks Wannamaker said that a "large majority of the commissioners feel that they have not had the proper cooperation from the chief highway commissioner." Mr. Williamson's term ran until 1949.

A month ago Mr. Williamson declined the commission's offer as federal-state liaison officer, a new post, at a higher salary.

Mr. McMillan, succeeding to the $7,500 a year post, became chief engineer when Mr. Williamson stepped up from that job in 1940 to succeed the late Chief Highway Commissioner Ben M. Sawyer.

Mr. McMillan, 45, has been with the department for the last 25 years.

Metcalf & Eddy to design arctic shelter for Army

Since publication of the description of prefabricated shelters being developed for troops in arctic climates (*ENR* July 17, vol. p. 92), it was disclosed that Metcalf & Eddy, engineers of Boston, Mass., have been engaged to develop typical and standard designs. Such housing must be light weight, capable of providing an interior temperature of 70 deg. F. while it is 70 deg. below zero outside and strong enough to resist the force of a 125-mph. wind. Preliminary plans contemplate use of aluminum structural members and insulated sheet aluminum panels for walls, floor and roof.

Gen. M. L. Walker dies, former Canal Zone head

Brig. Gen. Meriweather L. Walker, 77, retired former governor of the Panama Canal Zone, died at Vineyard Haven, Mass., July 29.

General Walker was graduated from West Point in 1893, from the U. S. Engineer School three years later, and from the Army War College in 1920.

Commissioned a colonel in 1920, he had served as a brigadier general in the first World War, going to France as chief engineer of the Forty-first Division. He was principal assistant to the chief engineer of the American Expeditionary Forces and director of the Motor Transport Corps.

Before his service in France he was director of the Army Field Engineering School from 1912 to 1914, professor of practical military engineering at West Point from 1914 to 1916 and chief engineer of the 1916-17 punitive expedition into Mexico.

Upon his return from France General Walker served as instructor of the Army War College from 1919 to 1920 and commander of the United States Engineer School from 1920 to 1921. He was promoted to brigadier general in 1927, and after serving in the Canal Zone, commanded the Eighteenth Brigade at Boston. He retired in 1933.

Memphis bridge bids to be received Sept. 11

Bids for the construction of the superstructure of the new 4-lane Mississippi River Bridge at Memphis, Tenn., probably will be received by the Memphis and Arkansas Bridge Commission Sept. 11, E. H. Crump, commission chairman, said July 12.

ENGINEERING SCHOOL NEWS

Frozen soil tests by Purdue researchers—New civil engineering head at Stanford — A $1 million building for the University of British Columbia is planned

Tests of great value to the construction industry, and more especially to highway builders, will be conducted by a selected group of Purdue University research experts in the permanently frozen soil of Alaska, it was revealed recently at Purdue. The group will join the Permafrost Division of the St. Paul District Army Corps of Engineers staff in conducting the experiments for joint highway research of Purdue and the Indiana State Highway Commission.

Robert E. Frost of the Highway Research Staff at Purdue, a specialist in airphoto interpretation, left several weeks ago for Anchorage and Fairbanks. Prof. K. B. Woods, associate director of the highway research project, has left by air for a stay of several weeks in Alaska. Other staff members about to leave are Jean A. Hittle, W. S. Pollard, and C. R. McCullough. The staff will be stationed near Fairbanks for the duration of the experiments.

Eugene L. Grant, professor of economics of engineering, has been appointed head of the department of civil engineering at Stanford University. Professor Grant is well known for his books on engineering economics and statistical quality control and was the recipient of ASCE's Thomas Fitch Rowland prize in 1944 for a paper on depreciation. He replaces Prof. L. B. Reynolds, who will devote all his time to teaching his growing classes in sanitary and water supply engineering.

Contracts for construction of the Applied Science Building at the University of British Columbia have been awarded. The building was designed by Sharp & Thompson, Vancouver architects, and ultimately will cost a million dollars.

Miss Irma Elizabeth Amoratis, is the first woman to receive a degree from the Washington University School of Engineering, St. Louis, Mo. She was awarded her B.S. in civil engineering at the commencement exercises in June. She was 20 last March.

Prof. John O. Eichler has been named acting head of the civil engineering department at the Cooper Union School of Engineering, replacing Prof. Kenneth C. Reynolds, who has resigned to take charge of hydraulics instruction at the University of Southern California. Until last fall, when he joined the Cooper Union staff, Professor Eichler was on the faculty of civil engineering at Syracuse University and civil engineer for the state highway department at Syracuse. This year he has been in charge of surveying courses at Cooper Union, including those given this summer at the Green Engineering Camp at Ringwood, N. J.

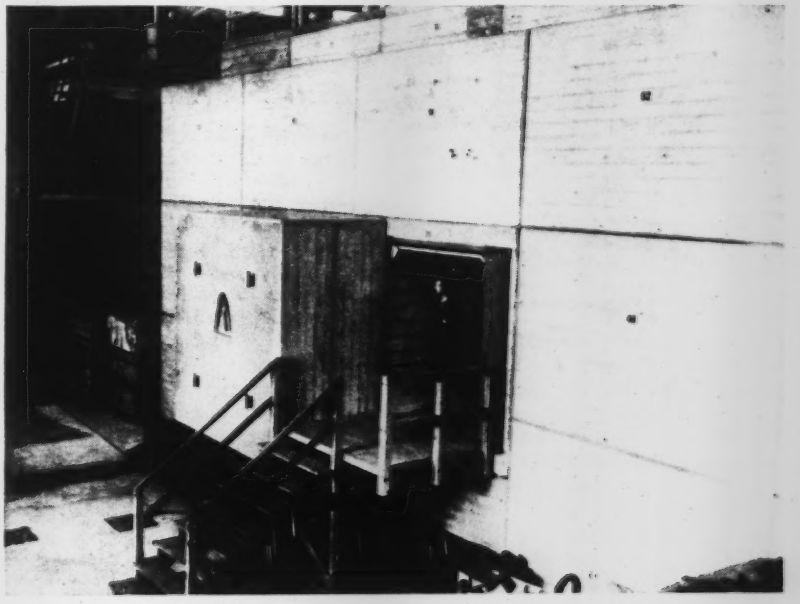
Carl Hugo Walther has been promoted from associate professor of civil engineering to full professor at the George Washington University, Washington, D. C. Appointed to the University faculty in September, 1939, he is now assistant dean of the school of engineering. He received both the B.S. in civil engineering and the M.C.E. from The Johns Hopkins University, where he held the W. W. Pagor graduate fellowship. In 1944-1946 he was structural consultant, Office of the Quartermaster General, U. S. Army.

Harold Harrison Dutton was promoted from associate in civil engineering to lecturer. He received the B.S. in civil engineering from George Washington in 1924 and has been on the faculty since 1941. He teaches materials and hydraulics laboratory. He is associated with the Bureau of Yards and Docks, Navy Yard.

Perry Harold Petersen was promoted from associate in civil engineering to lecturer. He received the B.S. in civil engineering from Cooper Union and has been on the faculty since October, 1945. He teaches materials of construction and is associated with the National Bureau of Standards.

The first graduate degree in engineering at Notre Dame University was given recently to Melvin Gelber, 23, of Hackensack, N. J. He had returned to Notre Dame after two years and a half in the Navy.

Civil engineering students at the University of Mississippi will face next fall an intensified new curriculum, with major emphasis on construction rather than design. Students will have the choice of either construction or city planning, public utilities and city government. In addition to the four normal academic years one summer surveying course is included.



***Concrete Wall for Cyclotron**—A concrete wall 5 ft. thick encases the 4,000-ton cyclotron at the University of California at Berkeley, Calif. Scientific tests have proved concrete the most convenient material for cutting off the deadly neutron ray radiation. Cyrill Orley, supervisor of technicians, stands at a control in the doorway. Dr. B. J. Moyer of the University told the American Physical Society meeting at Berkeley, July 12, that the concrete wall cuts off all but one per cent of the neutron ray.*

Random Lines *from an editor's notebook . . .*

. . . In which a member of the western staff notes progress in the comforts of living at Davis Dam

A visitor to the Davis Dam project on the Colorado River returning after a year's time, is of course impressed with construction progress, but just as striking is the advance made in providing comfortable living accommodations in this desolate area.

At peak periods, up to 1,300 workers are employed by the Utah Construction Co. and some 150 by the Bureau of Reclamation. Many of the Utah people and their families will have been on the job for a total of more than three years when the job is finished and the bureau must maintain a permanent townsite for operating personnel.

Of the family-type houses built to date, all but 20 belonging to the bureau are classed as temporary. "But," wryly observed H. F. Bahmeier, construction engineer, "there's seldom been a temporary house on a major bureau job yet."

Both organizations encourage the planting and maintaining of lawns, and even the trailer camp areas have lawns with little picket fences around them. These little splotches of green are cared for as proudly as if they were vast expanses in the best residential district of a big-city suburb.

Because of the scarcity of building materials during the last year, many of the housing units are surplus prefabs, ex-Army barracks buildings and the like. One of the bureau's new garage buildings still bears the sign "E. M. Latrine," familiar to GI's the world over but a little strange to bureau wives.

Four bridges cross river

A year ago there was only one bridge across the Colorado, now four trestles cross the stream and one spans the diversion channel. A year ago, although the job was well under way, there was no housing provided by the bureau or Utah except for one temporary bunkhouse and a little space in offices or shops. Now Utah's "town" has completed and put in use 49 single-family houses, five 7-family apartment buildings, 11 barracks-type dormitories, 50 FPHA trailers, and space for private trailers; altogether this adds up to accommodations for 170 families and 500 men.

Children attend a modern school with eight grades, built by Utah but now operated by the Clark County, Nev., school authorities. Buses take high school students the 30 miles to Kingman. A swimming pool has been built to restore energies during the hot summer when 105 deg. temperatures are normal and 120 not uncommon in this region.

The men in the Utah's messhall look like any wartime group of Seabees, only maybe these men are a little older. Many of them wear the Seabee green shirt and baseball caps, mementos of Tinian, Samar, Okinawa or Yokosuka. One or two of the men have prosthetic devices where hands or arms used to be —victims perhaps of construction jobs of long ago. However, construction is their forte so they are still at it.

Airfield-like maintenance procedures are followed by the men under Dino Thiessen, master mechanic. Some five extra engines are on hand for the 40-odd Euclid earthmovers. When an engine goes bad—and with the punishment they take under 24-hour operation in the dust, grit and heat of this desert location they can't help going bad—the old engine is pulled out and replaced with a newly reconditioned one, fresh from a 72-hour continuous test run.—*L. L. W.*

Actual work has started on Bull Shoals Dam

With preliminary projects nearing completion, actual work on Bull Shoals dam, near Mountain Home, Ark., has started. Using a 3½-yard drag-line, the Ozark Dam Constructors has started excavation on the right abutment, which will require moving 800,000 cu. yd. of dirt before the dam is completed.

Excavation for the first diversion of the river around the dam site is expected to start in August. Temporary office buildings are being constructed at the site, and a ferry, to be used until a construction bridge is built, is being installed.

Unlike the construction system used on the nearby Norfork Dam (*ENR* Dec. 27, 1945 vol. p. 878,) which required erection of the largest cableway ever built, the project will be constructed by the "trestle and hammerhead crane" system. Concrete will be hauled from the mixing plant to placing position by locomotive-powered cars and hammerhead cranes will move buckets of concrete to the forms.

BAILEY BRIDGE SAVES $32,000

A war surplus Bailey bridge proved the answer to a construction problem that had bothered officials of Grays Harbor County, Wash., since the collapse several months ago of a bridge over the North River in an isolated section of the county.

The county called bids for reconstruction of the bridge but rejected them as too high when they exceeded $40,000. As the bridge served only ten families, the county commissioners decided such a cost would not be justified. Instead, the county purchased a Bailey bridge for $7,800 and a county crew under the direction of J. H. Kirkwood, county engineer, built the approaches and new piers. The 5-man crew spent less than 30 working days on the bridge.

The bridge has one 12-ft. traffic lane and will carry a 50-ton load. Walkway units may be installed along one side of the bridge at a later date. The bridge span is about 100 ft. from pier to pier.

Permeable jetties fail to stop Erie erosion

The five permeable jetties about 230 ft. apart, constructed at a cost of over $100,000 two years ago (*ENR* July 12, 1945, vol. p. 19) to halt erosion on Perkins Beach, Cleveland, Ohio, have failed of their purpose, according to City Engineer John C. Wenrick, and most of them will be buried beneath fill dirt as the city turns to a new scheme against the inroads of Lake Erie.

Not only has most of the beach disappeared, but more important, is the condition of Cliff Drive, overlooking the beach and the lake, which threatens to topple into the lake from cave-ins and undermining. The guard rail has become loosened and cracks in the street's pavement indicate the seriousness of its condition. Approximately 15 ft. of earth has been eroded away this year from the edge of the bank to the edge of the pavement of the drive, necessitating the closing of the drive to the public.

The new plan, devised by Wenrick, calls for a wide fill that would furnish a sloping hill to extend over most of the permeable jetties, some of which extend into the lake 290 ft. The bottom of the lake is of shale.

Wenrick's recommendation that a heavy stone wall be built parallel to and 100 ft. out from the shore line and filled in behind, was ruled out in 1943 and in its place the plan advanced by Sydney Makepeace Wood, for installation of his patented jetties, was adopted.

OBITUARY

Robert A. McMenimen, 55, vice-president and a director of the Raymond Concrete Pile Co., New York, died July 30 in Monrovia, Liberia, where he was inspecting the completion of a large harbor development project. Mr. McMenimen, a civil engineer graduate of Massachusetts Institute of Technology was engaged early in 1917 in construction work on the New York subway system. During the last war he was a member of the operating committee of the Contractors' Pacific Naval Air Bases, a group that directed widespread building activities for the Navy in the Pacific theater. He became a vice-president of the Raymond company in 1945.

J. Ogden Marsh, 82, died July 15 at Glendale, Calif. In the early 90's he worked on construction problems on the Terminal Railroad to San Pedro and later was in charge of the survey for the Los Angeles-Riverside section of what is now the Union Pacific line to Salt Lake City. He was employed from 1915 to 1925 by the California highway commission and from 1925 to 1936 he was general manager and chief engineer of the Los Angeles City board of public utilities and transportation.

Noble F. Latto, 61, civil engineer for the Pennsylvania Railroad for 37 years, died July 19 in Akron, O. He was a graduate of Otterbein College.

William S. Lea, 70, died recently at Senneville, Que. He was a civil engineer graduate of McGill University, Montreal in 1908. For three years he taught at McGill and then for two years he was engineer for waterworks and bridges at Vancouver, B. C. He then joined his brother in the firm of R. S. and W. S. Lea, consulting engineers.

Foster B. Crutcher, 54, Baltimore, Md., died July 22. A 1915 graduate of Georgia School of Technology, from 1916 to 1918 he was employed by the General Electric Co. at Schenectady, N. Y. After service in the first world war he worked for various engineering firms in Philadelphia and New York, and with the Civil Works Administration and the Resettlement Administration. In 1942 he was commissioned a lieutenant commander in the U. S. Naval Reserve, Civil Engineer Corps and did construction work at the Navy base in San Juan, Puerto Rico. Later he was superintendent of utilities and design at the U. S. Naval Academy.

William M. Reid, 82, for 42 years with the Montreal Tramways Co. and lately engineer of maintenance of ways and structures, died recently.

William Frank Noot, 71, former civil engineer and superintendent in charge of construction at large, U. S. War Department, died July 19 at his home in Decatur, Ga. He had served with the government for 30 years.

Maj. Frederic W. Darlington, 82, construction engineer, died July 23 at West Chester, Pa. He was widely known for his construction of electric railroads. A graduate of Yale in 1888, he supervised construction of a pioneer electric railroad—a 14-mile line between Riverside and San Bernardino, in California. In 1892, while serving as chief engineer of the Philadelphia Traction Co., he supervised the task of converting 450 miles of horse car track into electrified street railway in Philadelphia. He also worked on electrification projects in Japan.

Edward F. Brayer, a construction engineer, died recently at his home in Auburn, N. Y. Mr. Brayer moved to Auburn 45 years ago and established the Edward F. Brayer Construction Co., later the Brayer Bros. Contracting Company.

B. A. Alderman, 57, of Atlanta, Ga., died recently. Mr. Alderman had been with the Georgia State Highway Department for 25 years.

Cecil M. Miller, 55, civil engineer of Seattle, Wash., died there July 24. He served in the first World War as a noncommissioned officer with the Corps of Engineers and in the second as a civilian with the Army Engineers. He attended the University of Washington.

(*News continued on page* 142)

MAJOR MEETINGS

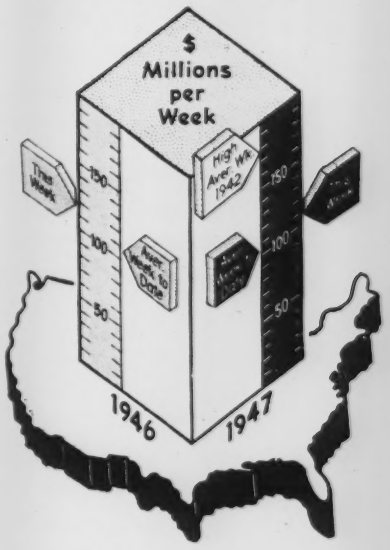
Associated General Contractors of America, Inc., fall meeting, Savery Hotel, Des Moines, Iowa, Sept. 28-Oct. 1.

Institute of Traffic Engineers, 18th annual meeting, Hotel Fort Shelby, Detroit, Mich., Oct. 1-4.

American Society of Civil Engineers, fall meeting, Roosevelt Hotel, Jacksonville, Fla., Oct. 13-17.

American Welding Society, annual meeting, Sherman Hotel, Chicago, Ill., Oct. 20-24.

CONSTRUCTION ACTIVITY



As Reported this week to . . .
Engineering News-Record

CONTRACT VOLUME

Continental U. S. Only (Thousands of Dollars)

	Week of Aug. 7 1947	Cumulative 1947 (32 wks)	Cumulative 1946 (32 wks)
Federal	$16,580	$425,255	$476,586
State & Mun.	45,245	1,038,917	858,862
Total Public.	$61,825	$1,464,172	$1,335,448
Total Private	47,943	1,843,699	2,044,413
U. S. Total	**$109,768**	**$3,307,871**	**$3,379,861**

WHERE CONSTRUCTION ACTIVITY ORIGINATED THIS WEEK

Dollar Volume (Thousands)

Type of Work	This Week	Cumulative 1947 (32 wks)	Cumulative 1946 (32 wks)
Waterworks ..	$2,035	$67,700	$63,040
Sewerage	4,153	80,566	61,830
Bridges	4,733	106,279	82,007
Highways	20,913	495,341	499,989
Earthwork, Waterways	3,418	194,127	260,351
Buildings, Public	25,492	351,136	246,272
Industrial ..	14,412	495,147	643,996
Commercial .	32,087	1,082,062	1,276,071
Unclassified ..	2,525	435,453	246,305

NOTE: Minimum size projects included are: Waterworks and waterway projects, $22,500; other public works, $40,000; industrial buildings, $55,000; other buildings, $205,000.

NEW PRODUCTIVE CAPITAL

	Cumulative 1947 (32 wks)	Cumulative 1946 (32 wks)
NON-FEDERAL ...	$1,483,035	$1,063,086
Corporate Securities	517,486	363,368
State and Municipal	717,838	534,718
Fed. Aid Highway..	247,711	225,000
FEDERAL	1,818,729	1,556,375
Total Capital	**$3,301,764**	**$2,619,461**

ENR INDEX NUMBERS

Index Base = 100		1913	1926
Construction Cost..	Aug. '47	415.00	199.49
Building Cost.....	Aug. '47	313.03	169.21
Volume	July '47	222	97

EDITORIALS

VOLUME 139 NUMBER 6

August 7, 1947

Quick Action Needed

CONGRESS has passed legislation authorizing establishment of a National Science Foundation to be administered by a board of directors of 24 recognized leaders appointed by the President from the fields of science, engineering, education or public affairs. Who the engineering representatives on this body shall be, therefore, becomes a matter of immediate and commanding importance. Three requirements or qualifications seem essential: They should be men who are sufficiently well known to assure wide acceptance of their nomination; who have enough breadth of vision and initiative to secure a just share of attention and of funds for engineering research in the face of the persuasive demands of the nuclear physicists, biologists and others; and who are of such recognized administrative ability as to insure the selection of at least one of them for a place on the nine-man executive committee. The selection is a task for the Engineers Joint Council. No time should be lost in picking the men and in presenting their qualifications to the President convincingly.

From the Construction News Ticker

FOREGOING THE TEMPTATION to draw any editorial conclusions, here are a few items deserving of reflection that have come to light during the past week: Veterans' hospitals that were estimated at 75 to 90 cents per cubic foot in 1944, raised to $1.28 in 1946, and to $1.40 in 1947, are now being bid at $1.80; few contracts are being let, except in the South where the cost rise has been the least . . . Federal Works Agency records show that advanced planning of public works is most active in the South, has almost disappeared in some other sections of the country. . . The highway composite mile cost for the nation as a whole is 167 percent of the 1940 cost. About 20 percent of highway bids are being rejected. Small, short-term highway contracts are increasing in frequency. . . The Corps of Engineers is able to award contracts within its estimates everywhere except in the Great Lakes area and around East St. Louis, Ill. . . The Bureau of Reclamation is rejecting a good many bids, but without much hope that future costs will be any lower. Dam building costs are about 170 percent of what they were in 1939. . . A good many masons actually regard 500 bricks as a fair day's work. . . The steel industry ups structural prices $6 a ton, but tacks $11 onto the price of a ton of reinforcing bars. The steel price rise adds 7½ points to the ENR Cost Index, about the same as each of the past two wage increases have added. . . The reader can fashion his own editorials around these facts. One that occurs to us would relate to our reputed $225 billion rate of national income: We are not accomplishing much if any more than we ever did, we are just paying twice as much for our goods and services.

Water Cross-Connections

THE REPORT that some 3,000 cross-connections have been discovered in the Seattle water system over a two-and-one-half year period (*ENR* July 10), gives point to the risk that all cities continually face from this cause. If such a number of cross-connections, previously overlooked, exist in a city whose water department is carefully administered, the number on other water systems must also be of alarming proportions. Constant vigilance is required to detect and remove the hazards of water-sewerage cross-connections.

No Cure-All

PRESIDENT TRUMAN in his flood-control message to Congress indicated that he still believes in valley authorities. Like views as to the magic of organizations like the TVA are found in the editorial columns of many newspapers in comment on the recent floods in the central part of the Mississippi valley. In each instance the fact is overlooked that even the TVA has not completely solved the flood problem in the Tennessee valley by building reservoirs and persuading farmers to contour-plow their lands. And the larger the river basin, the more difficult the problem becomes. Reservoir storage will reduce flood crests somewhat, but there just are not enough practical reservoir sites in the Mississippi and Missouri basins, at points where rainfall is greatest, to store anywhere near all the water that must be stored for full protection. Levees still will be required to protect the most valuable lands, and many low-lying areas where the construction of levees is not justified will still be flooded in times of abnormal rainfall. No new agencies need to be set up to discover these cold

facts and, by exercising a reasonable amount of cooperation, existing agencies can provide all the protection that is practical.

Not So Black

ONE OBSERVATION concerning the Senate Special War Investigating Committee report on the Inter-American Highway should be made in fairness to the engineers and contractors most directly concerned. It is that the picture painted by that report (*ENR* July 17, vol. p. 79) probably would not be so black if facts now shrouded in military and diplomatic secrecy could be made known.

President Roosevelt may well have realized that the highway could not be built in time to be of any use as a means of communication between this country and the Panama Canal, but he may also have concluded that the best way to keep the Japanese from establishing bases in Central America was to have engineers and construction forces from this country moving around down there, ostensibly building highways. He certainly knew that it would strengthen our standing in the countries where war had created unemployment if we made jobs by a road-building program.

If we view the war interlude on the Inter-American Highway from the angle of strengthening our prestige with Central American political leaders, some of its strange routings and branches take on a different aspect. Support for this conclusion is found in a report that was in circulation at the time to the effect that contractors on the job would be expected to "take care of the local politicians." This would also explain some of the startlingly high figures in the construction contracts.

These possibilities need to be taken into consideration in weighing the findings of the Congressional investigation. They do not, however, excuse the disgraceful lack of coordination and cooperation between the Army Engineers and the Public Roads Administration in Central America. Jealousies between public agencies are bad at any time, but are inexcusable in time of war.

And one other observation is appropriate before the report is put away in the archives. It is that while there may be justification for dispensing favors to Central American politicians in wartime, there is absolutely no excuse for such practice in peacetime. The PRA says two more years and $60 million of U. S. money will be required to complete the Inter-American Highway. Not one cent of this should go for tribute. We can use a new foreign policy south of the border just as much as elsewhere.

Sewage Effluents for Industrial Use

NO BETTER AUDIENCE could have been chosen than that provided at the recent joint meeting of the American Water Works Association and the Federation of Sewage Works Associations (*ENR* July 31, vol. p. 147) for a discussion on the use of reclaimed sewage effluents for a supplemental water supply. As presented by N. T. Veatch, consulting engineer of Kansas City, the matter is one that commands wide attention because of its economic implications and possibilities for water conservation.

Mr. Veatch cited nine instances where effluents are being used or considered for use in industrial establishments, and he pointed to 125 applications in this country for agricultural irrigation. While the latter is an old and well-established development, the economic and other advantages related to the use of reclaimed sewage liquids for industrial purposes have not generally been appreciated. It was pointed out that in each case where it has been employed or proposed the industry not only secures processing water at a cost lower than that from any other possible source, but in several instances the sale of the effluent by the municipality has netted a substantial financial return. Furthermore, there seem to be no problems of a technical nature in making such applications.

Presentation of these facts before the two national organizations concerned respectively with water and sewage developments should go far in stimulating further exploration of effluent reclamation. The benefits can be threefold: To the waterworks man harassed by growing industrial needs the use of effluent may lessen demands on an overburdened system; to the sewage works administrator the sale of an otherwise wasted product can produce revenue for operating needs and better facilities; and to industry there may accrue tangible benefits in the form of cheaper process water.

ENGINEERING NEWS-RECORD
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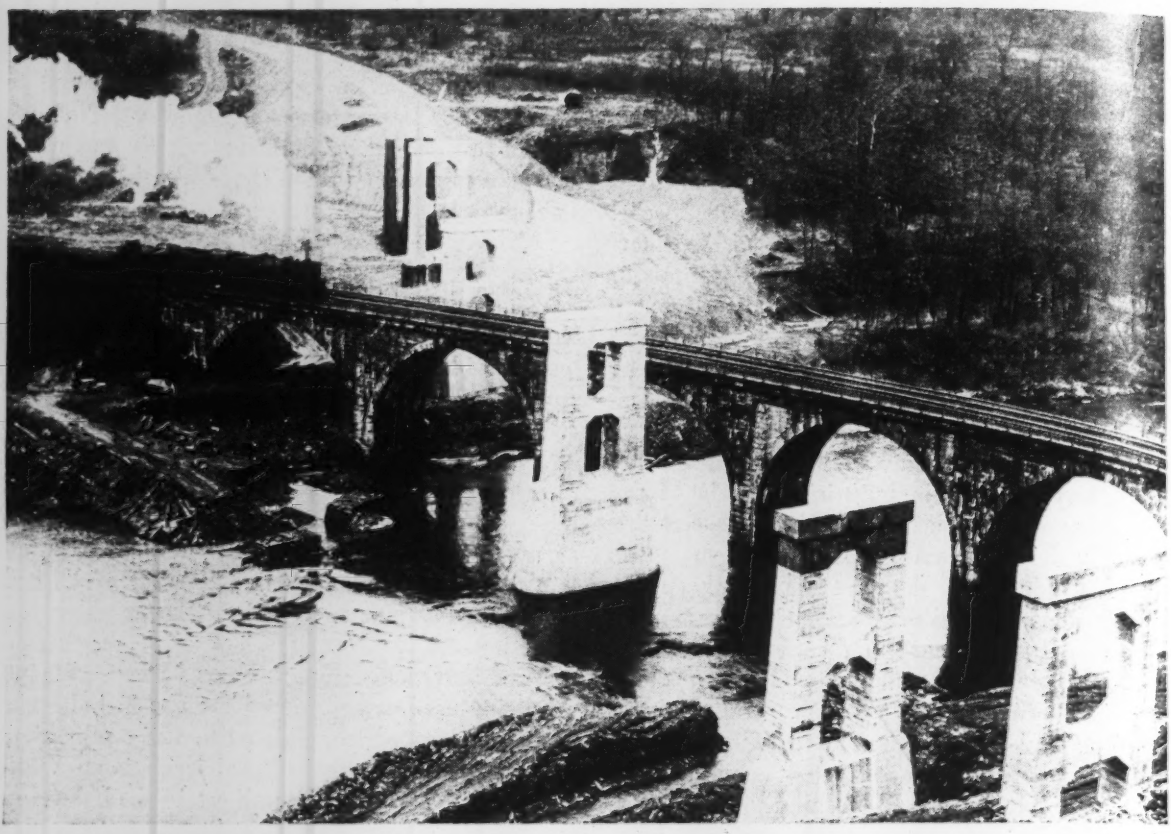

Fig. 1. Relocation of 16 miles of railroad at Conemaugh Dam requires high-level bridges carrying two lines of track.

Railroad Relocated Above Conemaugh Dam

***Contents in Brief**—Preliminary work incidental to the actual construction of Conemaugh Dam near Pittsburgh, Pa. will require 2½ years for completion. Major projects include 16 miles of Pennsylvania Railroad relocation and a 2,660 ft. double-track tunnel to remove present trackage from the area to be occupied by the reservoir. New bridges, with unusually high piers, are designed for economy of superstructure steel fabrication and maximum reuse of shop-fabricated timber forms for concrete substructures.*

WHILE CONSTRUCTION of the dam itself, usually receives first attention in published reports on large reservoir projects, other items in the project occasionally assume larger proportions both in the amount of work involved and cost of construction. Such is the case of the Conemaugh reservoir flood-control project now under construction by the Corps of Engineers on the Conemaugh River about 30 miles east of Pittsburgh, Pa.

For example, initial work on the project involves relocation of 16 miles of Pennsylvania Railroad double-track line to replace present trackage that will be inundated when the reservoir is completed. Estimated cost of the relocation, which will require 2½ years for completion, is $12,656,000. By comparison, Conemaugh dam and its appurtenances, are estimated to cost only $9,600,000. The entire flood-control project will cost about $30,500,000, including nearly $3,000,000 for highway relocation.

Preliminary estimates of the costs of constructing the various components of the entire project, some of which may be adjusted substantially by the time contracts are let for the work, are as follows:

Dam structure and appurtenances	$9,600,000
Railroad relocation	12,656,000
Highway relocation	2,866,000
Buildings and property damage	2,704,000
Utilities relocation	866,000
Mineral resources damage	658,000
Clearing of site	534,000
Coal mine protection	404,000
Tunnel closures	99,000
Crop damage	70,000
Total	$30,457,000

As a general policy the Corps of Engineers has designed, and is building, the 16 miles of relocated railroad to a standard comparable with that of the existing line. Any needed improvements beyond that level will be paid for by the railroad company. It is being built to a 0.3 percent compensated grade, with 5-deg. maximum curvature—comparable to grade and alignment of the old line.

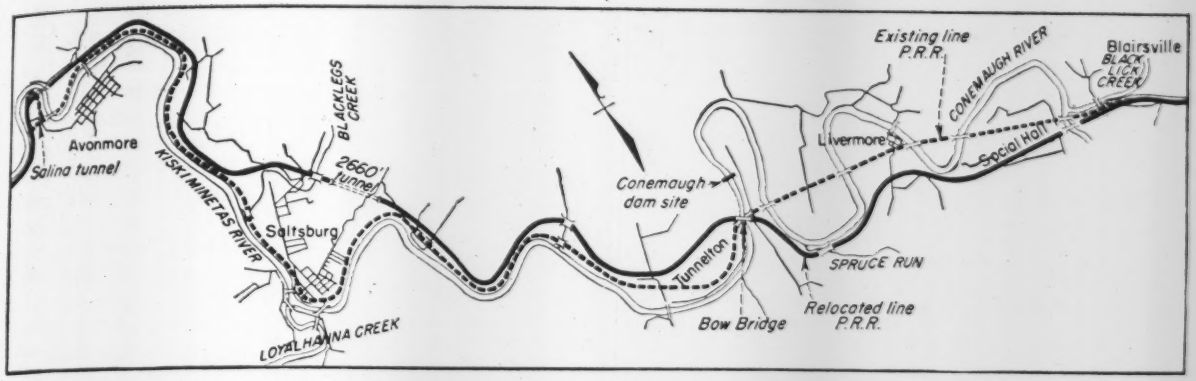

Fig. 2. Four old railroad bridges over the Conemaugh River, within the reservoir area, are eliminated by the new relocation. Six major bridges, however, are required for the new line.

The new location is part of the Conemaugh Division of the Pennsylvania R.R. and constitutes a main east-west freight route. An indication of its importance as a freight carrier can be gained from the fact that this line handles a daily average of 60 trains hauling some 230,000 tons of freight. Heaviest locomotive operating over the line weighs 1,053,000 lb., including tender.

Open cut 189-ft. deep

The upstream end of the relocation begins about one mile east of the old Social Hall Bridge over the Conemaugh River (Fig. 2). It follows the left side of the valley (looking downstream) to a ridge in a large bow of the river where it passes through the ridge in a 189-ft. open cut in solid rock and indurated clay, and crosses the river high above the existing railroad bridge (Bow Bridge). From there the line continues along the right side of the river roughly paralleling, but considerably higher than, the existing line. The relocation will bypass Saltsburg, Pa., pass through a 2,660-ft. tunnel and continue to a point about one mile west of Saltsburg.

From this point the new line will parallel the Kiskiminetas River and the existing railroad to a point opposite Avonmore where it will cross the Kiskiminetas to join the present line near the western portal of the existing Salina tunnel.

In addition to the 16 miles of double-track relocation on the Conemaugh Division of the Pennsylvania R.R., considerable adjustment of the Indiana Branch of the railroad will be required near Blairsville, Pa. This includes a new bridge over the Conemaugh, relocation of about 2½ miles of single track and a 4-ft. raise of about one mile of existing track near Black Lick, Pa.

Three tunnel closures needed

Relocation of the railroad also includes the closure of three existing tunnels through a neck of land in a "bow" of the Conemaugh River. One is an 800- ft. long, 20-ft. dia. abandoned tunnel of the old Pennsylvania canal. Another is a 650-ft. horseshoe shape tunnel abandoned several years ago by the railroad, and the third tunnel, which is 750 ft. long is on the existing line. All tunnels will be sealed with concrete plugs near their upstream ends, beyond the zone of hillside weathering.

Construction got underway on the grading for the relocation and the double-track tunnel in April, 1946. The work passes through rugged terrain involving many heavy cuts and fills, and the construction of six major bridges in addition to the tunnel. For the most part, hauls were

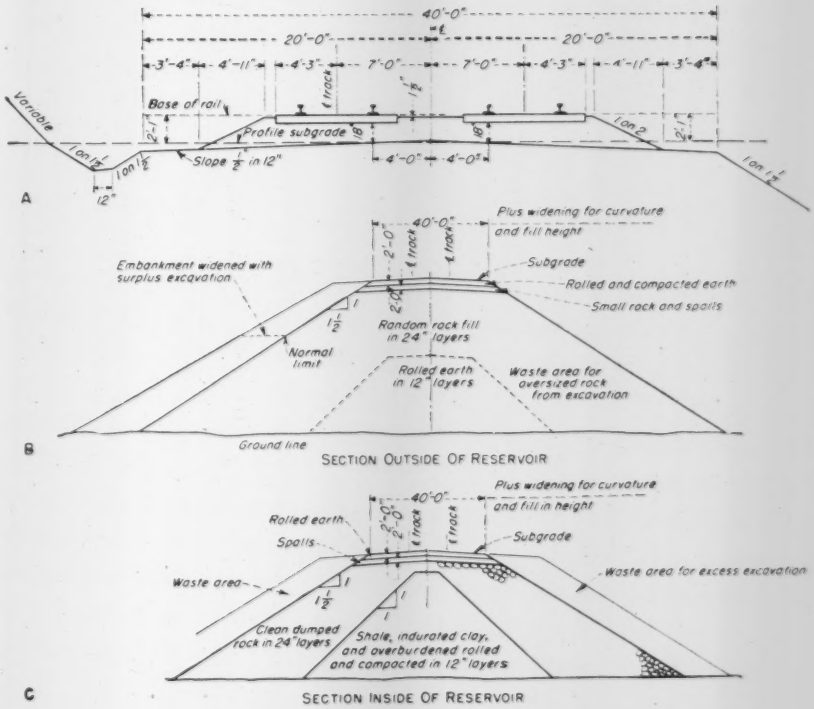

Fig. 3. Normal crown width of railroad embankment is 40 ft. for two lines of track (A). Outside of the reservoir area the embankment is rolled-earth and random rock fill (B), while inside this area random-shale and earth embankment is faced with selected rock (C).

Fig. 4. At Bow Ridge, maximum depth of cut was 189 ft., most of which was in solid rock and indurated clay which required drilling and blasting.

Fig. 5. Drilling of the 30x26-ft. main bore of the double-track tunnel was by a jumbo drill carriage operating on railroad rails. Temporary timber lagging at the west portal was replaced with permanent structural beam ribs.

short with much of the excavated material being wasted. In Bow Cut, some 900,000 cu. yd. were wasted.

There were several bad slides during construction. One in particular involved 250,000 cu. yd. from a bed of fire clay lying on a steep angle. It was necessary to excavate the material clear down to the line of slippage.

Some 3,000,000 cu. yd. of earth and rock excavation are involved in the relocation project, 2,300,000 lb. of reinforcing steel and about 60,000 cu. yd. of concrete including bridges and tunnel lining. At this writing the grading contractors have moved about 2,500,000 cu. yd. of excavation and placed over 40,000 cu. yd. of concrete. All substructures of the six major bridges have been completed and the entire grading contract is expected to be finished late this fall.

The grading contractor maintained his own repair shop, located at camp headquarters, where normal repairs were made to all equipment. Some special repairs also were made in this shop such as strengthening bulldozer blades by welding a facing plate onto the blades, and strengthening some pusher frames on heavy scrapers to prevent their cracking during loading operations in the heavy muck encountered. Facing plates also were welded to pusher blocks on the big scrapers, and metal cabs were added to some of the dump trucks to give added protection to the operators.

Repair and maintenance of the approximately 500 pneumatic tires on the earthmoving equipment, the largest of which was a 24.00x32-in., 36-ply tire, was done by contract with a local tire service company. Two repairmen, with complete facilities for all but the largest tire repairs, were kept out on the job at all times. The larger tires were repaired in the service company's main repair shop.

One tunnel required

Despite the rugged terrain traversed, only one tunnel is required in the 16 miles of railroad relocation. Located just east of Saltsburg, it is to be 2,660 ft. long, concrete lined, and designed for two lines of track. Finished dimensions call for a 30-ft. inside width, vertical side walls to the spring line 15 ft. 7 in. above base of rail, and a three-center roof of 22-ft. and 8-ft. radii. Over-all clear inside height is 26 ft.

Starting in April, 1946, the contractor first drove a pilot tunnel, roughly 15 ft. square, holing through in December. For this phase of the work, forced ventilation was required at all times. A five-drill jumbo was used for all drilling, while haulage was by an electric mucking machine and 5-cu. yd. dump trucks operating on a narrow gage track.

Drilling of the main bore, currently underway, is expected to be completed in October, with concreting of the lining planned to be started one month later and completed by May 1, 1948.

No timbering was needed in the pilot tunnel, but the main bore is being lined with permanent steel plate and structural beam ribs, as

work progresses. Due to the presence of the pilot tunnel, no forced ventilation is needed in the main bore, which is being advanced at an average rate of 20 ft. per day. All drilling is by a jumbo drill carriage, mounting nine drifters and operating on railroad rails.

The normal drill pattern contains 10 holes on each side of the pilot tunnel and 60 around the arch. Holes are drilled 20 ft. deep, horizontally, and loaded with about 12 lb. of 45-percent strength dynamite, which produces on an average of 1 cu. yd. of excavated material per pound of dynamite used.

Mining operations are set up for one complete round of drilling, blasting and mucking per 24 hours. All mucking in the main bore is by a 1¼-cu. yd. electric shovel, aided by a tractor with bulldozer operating in the pilot tunnel. Haulage is done with three 13-cu. yd. diesel-powered dump trucks and one crawler tractor with an 8-cu. yd. scraper.

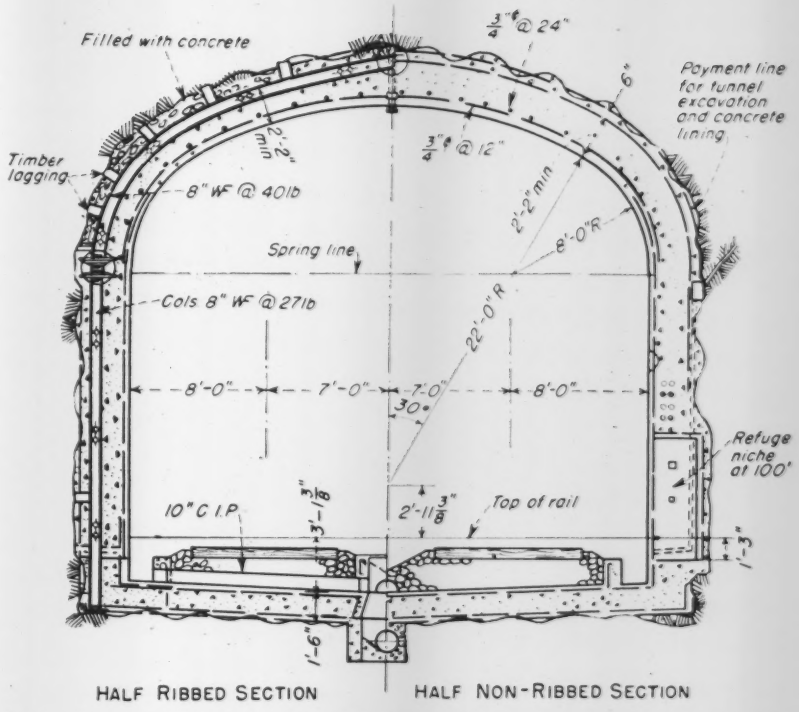

Fig. 6. Generous dimensions of the tunnel bore were reflected in a lower bid price for excavation, by providing more working space for equipment.

Six major bridges

The next feature of the Conemaugh flood-control project to be started will be the bridge superstructures. It is planned to award contracts for fabricating and erecting bridge structures as soon as additional funds are appropriated. Total cost of the six major bridge superstructures is expected to be $1,950,000. Contracts for necessary track work, estimated to cost $1,500,000, will be let about one year after awarding final bridge contracts, with completion date scheduled for eight months thereafter.

In the meantime, it is anticipated that work will get under way on construction of the dam itself. It is to be located about 2 miles upstream from Tunnelton, Pa., on the Conemaugh.

Of the six major bridges in the project, three are worthy of note—Social Hall Bridge and Spruce Run Bridge both are in the reservoir area, hence must be built to clear full-pool elevation of 975. Bow Ridge Bridge, which crosses the Conemaugh about one mile below the damsite, also is a high-level bridge. Its height, however, was not based on required clearance above high water, but rather to establish a reasonable grade-in-cut across a high bow of the river at that point.

One unusual feature of the Bow Ridge Bridge is that one of its two 224-ft. river spans crosses the existing railroad river bridge at this point. Base of rail on the new bridge will be some 65 ft. above base of rail on the old bridge. Present plans are to leave the old stone-arch bridge in place to serve as an access road to government property in the vicinity of Conemaugh Dam.

Duplication of fabrication of the structural steel superstructures and design of concrete substructures to permit maximum reuse of form lumber—both aimed at economy of construction—are apparent in all bridge plans for this project.

Social Hall Bridge offered the greatest opportunity for such economy. It is 824 ft. long and contains eight 100-ft. deck plate girder spans in each of four lines, making a total of 32 girders.

Girders are braced in pairs, with top and bottom laterals and cross-frames, to carry the double track railroad. Each double-line of girders, together with its concrete deck slab, ballast and track will be an independent unit. The two interior curbs of each roadway will be joined with a continuous line of precast concrete capping slabs.

Each of the twin roadway decks includes a 15-in. concrete slab reinforced with welded frames of reinforcing bars. Concrete slabs are protected on top with 1½ in. of extra-hard premoulded planking and ¼ in. of waterproofing.

Ballast will be placed directly on the waterproofing and to a 10-in. minimum depth below ties. Each roadway deck has a 2-ft. 5-in. sidewalk on the outside made of precast concrete slabs on steel-frame brackets and carrying a pipe handrail.

The reinforced concrete piers of the Social Hall Bridge vary from 80 to 95 ft. in height. The upper 56 ft. of all seven piers are identical, which permitted maximum reuse of timber forms. This portion of each pier contains two rectangular columns tied together with a web-wall at their mid-height and at the bottom of the cap. It is built integrally with a supporting monolith of variable height which slopes in two directions down to a slab footing, 5 ft. thick.

Even for this lower section of the piers the contractor was able to effect considerable economy through mass production and reuse of forms except for the lower pours of the higher piers. Abutments for this

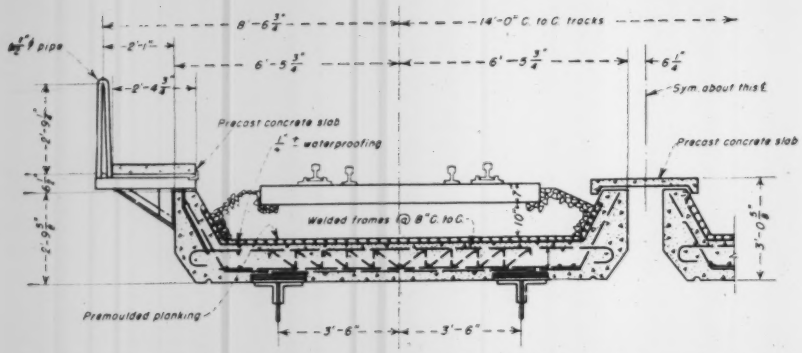

Fig. 7. Twin roadways of bridge decks are tied together with precast concrete capping slabs. Sidewalk slabs also are precast, on steel-frame brackets.

Fig. 8. Economy of construction and simplicity of erecting timber forms for concrete bridge substructures resulted from fabrication in a well-equipped shop.

bridge, which are nearly 90 ft. in height, are 3-column, spill-through type, on a single slab footing. Substructures of the other bridges follow the same general design as those of Social Hall bridge.

Although forms for various sections of substructure were reused as many as three times, it took some 400,000 b. ft. of lumber to form the 39,500 cu. yd. of concrete (exclusive of footings) in the 18 piers and 12 abutments of the six major bridges.

Shop fabricated forms for concrete

The quantity of timber to be used called for mass production and precision fabrication—all of which was done in a well-equipped, 80x40-ft. carpenter shop at the contractor's camp. In general, all forms were made of 2-in. facing lumber, in modular sections 4 ft. high by 6 ft. long, and reinforced with 2x6 and 2x8-in. ribs.

Erection was simplified, and much time and labor were saved at the bridge site by shop fabrication of the forms. Each section of form was stencilled to show the bridge and substructure for which it was intended, the location in that particular structure, and the order of its erection.

Lack of storage space both at the carpenter shop and at the bridge sites necessitated carefully planned production schedules in the shop to meet erection demands at the bridge sites. This, in itself, proved to be a point of economy by minimizing the handling of the form sections.

Concrete in the bridge substructures was placed in conventional manner. Materials were measured in a batching plant near each site, and hauled by truck to a paving mixer operating adjacent to the structure being constructed. The concrete, most of which was air-entrained, was dumped from the mixer directly into buckets and placed in the forms by crawler-type cranes.

Although Spruce Run Bridge is only 368 ft. long its central pier is 99 ft. high. The superstructure contains three 100-ft. through-girder spans spaced 32 ft. 8 in. apart to carry the double track, and one 65-ft. deck plate girder span, containing four lines of girders.

Bow Ridge Bridge, 879 ft. long, contains two 224-ft. deck truss spans, and three 105-ft., and one 97-ft. deck plate girder spans. This bridge contains the tallest pier in the project, measuring 107 ft. overall. It also has one abutment that measures 102 ft. from top of parapet to bottom of footing. It is of the 3-column, spill-through type on a skip footing.

Other major bridges on this project include a 259-ft., 3-span deck-plate girder over Blacklegs Creek, a through truss bridge of three 150-ft. spans over the Kiskiminetas River, and a 68-ft. single span deck plate girder over Long Run near the west end of the relocated line.

Construction personnel

All design and construction on the Conemaugh flood control reservoir project is under the supervision of Col. W. E. Lorence, district engineer, Pittsburgh District, Corps of Engineers. W. E. Sidney is chief, construction division, and Wilfred Bauknight is deputy chief. All field work is under the direct supervision of Donald D. Rait, resident engineer.

Three contracts covering grading for the 16 miles of railroad relocation and substructures for the six major bridges are held by the Hunkin-Conkey Construction Co., Cleveland, Ohio, and Shofner, Gordon & Hinman, Los Angeles, joint-venturers. V. F. Robertson is general manager for the contractors, and O. E. Kronenwetter is project engineer. Superintendents of construction are: D. R. Bartle; J. R. Riggs; R. L. Riggs; and F. C. Shons, who is in charge of bridge construction.

Herman Holmes, Crystal Falls, Mich., is the contractor on the 2,660-ft. tunnel. J. J. Carlotta is superintendent of tunnel construction, and M. T. Turcote is surface superintendent. The Pennsylvania Railroad is represented on the job by R. H. Crew, assistant to chief engineer, and J. T. Bean, chief inspector.

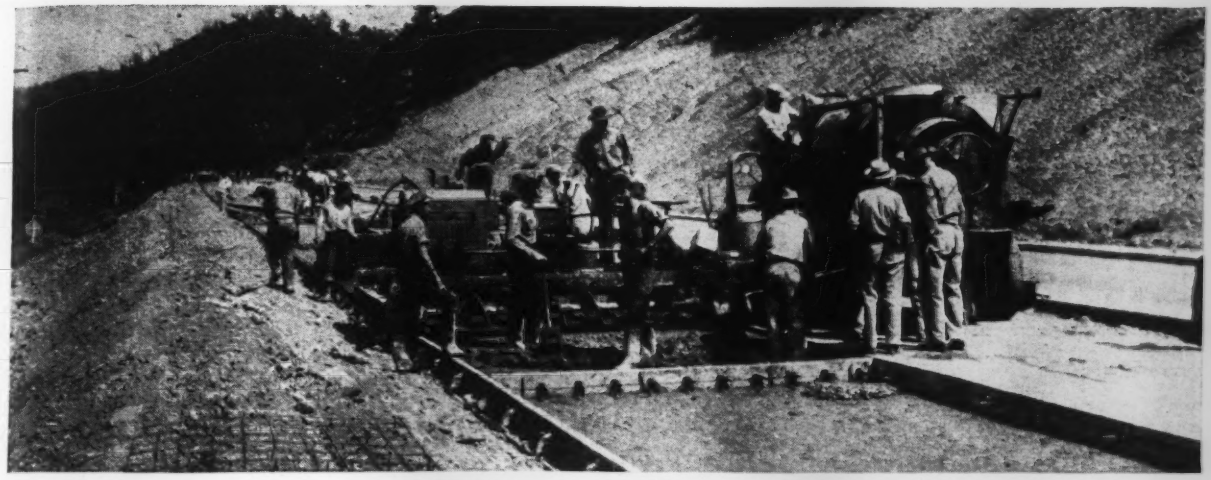

Fig. 1. The dual pavements were constructed one lane at a time with concrete manufactured in truck-mounted mixers.

Kanawha Boulevard Extended at Charleston

***Contents in Brief**—The dual-lane expressway leading eastward from the city of Charleston, W. Va., has been extended as two 22-ft. roadways separated by a 4-ft. median strip. To improve workability of the concrete and to prevent scaling of the pavement from winter salt treatment air-entraining cement was used. The project required the first semi-cloverleaf interchange built in West Virginia. Construction of a railroad underpass in a manner to avoid interruption of rail travel more than a few hours was also required.*

EXTENSION of the Kanawha Blvd. expressway leading eastward from the city of Charleston as part of the improvement of U. S. Route 60 has resulted in the use for the first time of air-entraining cement on a paving project of the West Virginia State Road Commission. Construction of the first semi-cloverleaf interchange for the West Virginia highway network was also required, and the work was further distinguished by construction of one of the first rigid-frame underpasses built by the commission.

The dual-lane highway now has a total length of 9.3 miles—4.8 miles within Charleston and 4.5 miles eastward from the city—which makes it the longest divided highway in West Virginia. Improvement of Kanawha Blvd. along the Kanawha River for the full length of the city was completed in 1940 as a PWA project (*ENR* March 13, 1941, vol. p. 414).

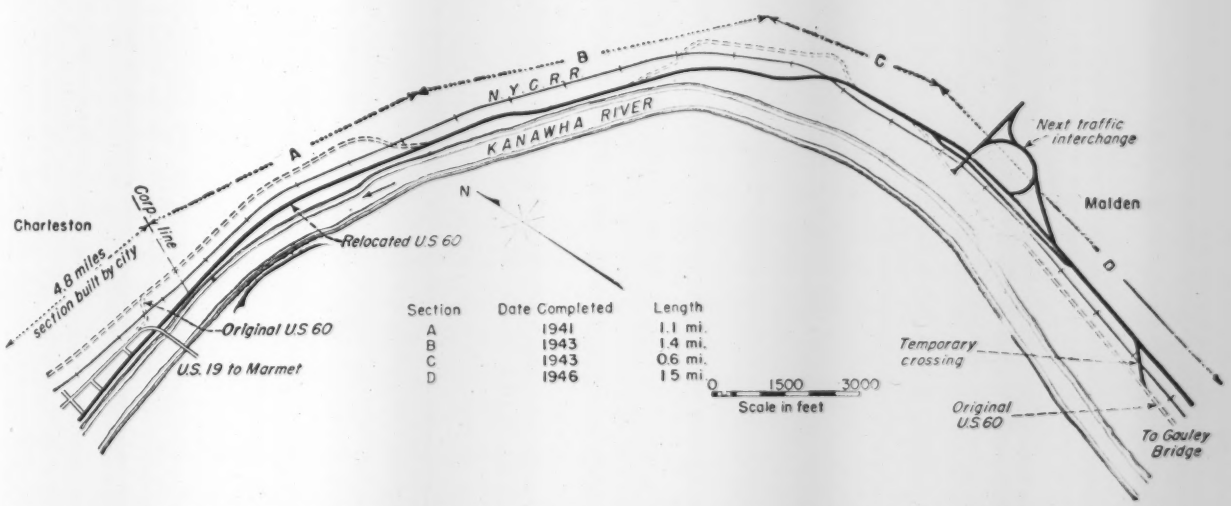

Fig. 2. The expressway now has total length of 9.3 miles, including 4.8 miles within the city of Charleston. By relocating the road, four crossings of New York Central R. R. at grade were eliminated.

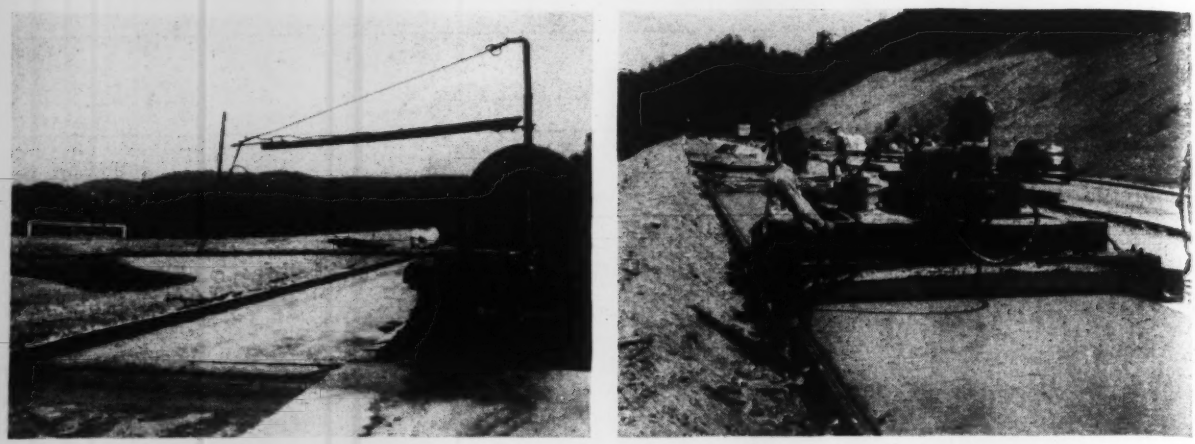

Fig. 3. Sprinkling of the subgrade previous to constructing roadway was simplified by special attachment shown in left photo; when the truck left the job for a refill the perforated pipe was readily removed and the supporting arm swung over the top of the tank out of the way. A small vibrating machine mounted on the front of ths finisher permitted vibration of concrete adjacent to side forms (right photo).

In 1941 the state road commission extended the expressway more than a mile up the river, a specially designed rockfill being used to support toe of the long fill constructed immediately adjacent to the river (*ENR* Dec. 4, 1941, vol. p. 789). In 1943 two additional projects totaling nearly two miles were added, followed by a 1.5-mile extension in 1946.

Alignment improved

As shown by the accompanying map, the alignment of the expressway is a great improvement over the old narrow highway it replaces. Four dangerous crossings of the busy tracks of the New York Central R. R., which parallels the highway, have been eliminated. Plans are now being prepared to extend the expressway between 6 and 7 miles farther eastward or all the way to the town of Witcher.

The extension built in 1946 is 1.5 miles in length and provides two 22-ft. roadways separated by a 4-ft. median strip with mountable curbs and a 3-ft. grass plot. Shoulder widths are 7 ft. 6 in. on fill sections and 6 ft. in cuts. The pavement is of 8-in. uniform thickness reinforced with a single layer of mesh reinforcing placed 2-in. below the top of the slab. Doweled expansion joints are provided at 93-ft. intervals and doweled contraction joints on a 31-ft. spacing. To secure a stable subgrade and adequate drainage, 4 in. of creek gravel were added directly beneath the pavement. Maximum size stone in the gravel was limited to 2 inches in diameter and 30 to 50 percent had to pass a No. 4 sieve.

Use of the air-entraining cement in constructing the pavements is expected to permit abrasives containing salts to be added on the pavements in winter without causing scaling of the upper surface of the slabs. Excellent workability also resulted from use of the admixture, which consisted of a resinous compound added at the cement mill.

The concrete mix specified was designed to produce a 3,000-lb. concrete at 14 days in which the voids totaled not over 5 percent on a volume basis; the average air entrainment was 4.8 percent. Ohio River sand and coarse gravel aggregate were

Fig. 4. At town of Malden a semi-cloverleaf was constructed to permit free flow of travel for extensive traffic leaving and entering highway at this point. This photograph, which is looking toward city of Charleston, shows at the far left the underpass built to carry cross road under railroad paralleling highway.

Fig. 5. To eliminate interruption of rail traffic in building the railroad underpass, the tracks were supported on timber bents during construction of foundations (left photo). The superstructure was built at one side and pulled into place (right photo). With this procedure, rail travel was interrupted only two hours.

used, and the materials required for a 3-cu. yd. batch were as follows:

Coarse aggregate.....	6,124 lb.
Sand	3,209 "
Cement	1,692 "
Water	100 gal.

The concrete was delivered in truck-mounted mixers and a maximum mixing time of 5 min. was specified. At the central batching plant about 50 gal. of the water was added with the remainder put in at the paving site. Care was exercised to produce a concrete with a slump of not over 3 in. The numerous cylinders tested in the laboratory revealed that the concrete had a 7-day compressive strength of 3,400 psi.

Each 11-ft. lane was constructed as a single operation, the two adjacent slabs for a roadway being joined together by tie hooks. Just previous to placing the concrete the porous subgrade material was compacted with several passes of a 10-ton three-wheel roller and the compacted material sprinkled rather heavily with water. To simplify this work the contractor employed the special sprinkling attachment illustrated by Fig. 3.

Normal procedure in adding the reinforcing mesh was for the mechanical spreader to make one pass before the reinforcing mat was added, or when sufficient concrete had been placed in the forms for slightly more than the lower 6 in. of the slab, then to make a second pass to finish the spreading operation. A mechanical finisher followed closely behind. On the front of this unit was mounted a small vibrator used to good advantage to vibrate the concrete immediately adjacent to the forms (Fig. 3).

The mechanical finisher was followed by a crew using a transverse hand float. Final finish was by dragging with wet burlap. Curing was with membrane compound applied with a small distributor pulled ahead as work advanced.

Traffic interchange built

Near the east end of the project at the town of Malden a semi-cloverleaf interchange was constructed to carry the expressway over Georgg's Creek Road (Fig. 4). The interchange is so designed that there will be no crossing of traffic at grade. Its construction is expected to provide great benefits in view of the fact that U. S. route 60 carries nearly 7,000 vehicles daily at this location; a flow of over 700 vehicles hourly during times of peak traffic is not unusual.

To carry traffic on George's Creek Road under the tracks of the New York Central R. R. a plate-girder underpass of two 37-ft. spans was constructed. Although the structure at present carries but one railroad track, the substructure was built sufficiently wide for a future second track. To avoid a long interruption to railroad traffic during construction of the bridge, the track at this location was supported on temporary bents while the foundations for the underpass were being built. Also, the superstructure of the bridge was erected on the extended portion of the substructure and then pulled into place with two hand winches. The latter operation required only 1 hr. and 40 min., and the total time railroad traffic was suspended was only about two hours.

The deck assembly pulled into position was that for both spans and thus it measured over 70 ft. in length. It consisted of eight lines of 30-in. 195-lb. wide-flange beams covered with a ¾-in. steel plate, four plies of asphaltic-treated felt, a single ply of asphaltic-treated concrete, and the stone ballast and track. The low reinforced concrete parapet walls provided at either side were added after the deck was in final position. The walls are supported on and tied to the outer beams with 1-in. dia. hooked bars on a frequent spacing.

The work was carried out as a federal-aid project by the West Virginia State Road Commission for which M. L. O'Neale is chief engineer, Geo. W. McAlpin, state construction engineer, L. L. Jemison, bridge engineer, and L. C. Madden, engineer of plans and surveys. Harry Shumate was project engineer.

For the Public Roads Administration, which partially financed the project, William Brewster is state engineer in West Virginia.

Ralph Myers Construction Co., Salem, Ind., held the general contract for the grading work, and the paving was done by V. N. Holderman, Columbus, Ohio. Monty Bros. Co., St. Albans, W. Va., built the two underpasses.

Fig. 1. Field erection of the precast concrete frame of the two-story Wilson Sporting Goods Co. plant in Pittsburgh was completed in 13 working days using a crew of six men and a crawler crane.

Precast Frame for Two-Story Plant Erected Like Structural Steel

***Contents in Brief**—Factory-made concrete units form the structural frame, second floor and roof of a two-story, 110x120-ft. sporting-goods sales building in Pittsburgh, Pa. The standardized shapes were erected on the site with a mobile crane, handling pieces directly from a motor trailer.*

THE GAP BETWEEN structural steel and reinforced concrete construction was virtually banished in a new, two-story sporting goods sales building in Pittsburgh, Pa. In a manner similar to that used for steel, the precast concrete frame was designed by selecting from a manufacturer's handbook the proper structural shapes to support the loads and was erected by a mobile crane directly from a motor trailer.

While this particular type of construction has been used before (*ENR* Feb. 25, 1943, vol. p. 302), it has been limited mainly to one-story buildings. Recently, a trend toward the use of precast concrete for two-story or higher structures appears to have started. The sporting-goods plant is typical of some 16 buildings of varying plan and column spacing, one- and two-stories high, all built in the Pittsburgh district during the last year.

Depending upon particular factors of locality, this type of construction may range in cost from less than that of standard steel framing to somewhat more, but at all times it would be at least 10 percent less than fireproofed steel structures, according to the fabricators, and can be provided in a shorter time with less trouble and work. The manufacturer of the units also claims that it costs 10 to 20 percent less than cast-in-place concrete and takes half the time to build. Standardized steel forms eliminate field construction of forms and the attendant delays, and the shop casting of concrete enables rigid control of mixing, placing and curing.

In plan, the Wilson Sporting Goods Co. plant is 110x120 ft., with 20x22-ft. bays. Exterior walls are of brick, with marble and glass facing on the street side.

Design highlights

The structure was designed for a live load of 125 psf. on floors and of 40 psf. on roofs. Design and details of construction complied with the requirements of the American Concrete Institute's "Building Regulations for Reinforced Concrete" and "The Concrete Regulations of the City of Pittsburgh." Specifications called for a concrete with a compressive strength at seven days of 5,000 psi., using Type III high-early cement and Allegheny River sand and gravel, and the design was accordingly based on a working stress of 2,250 psi. For the intermediate or

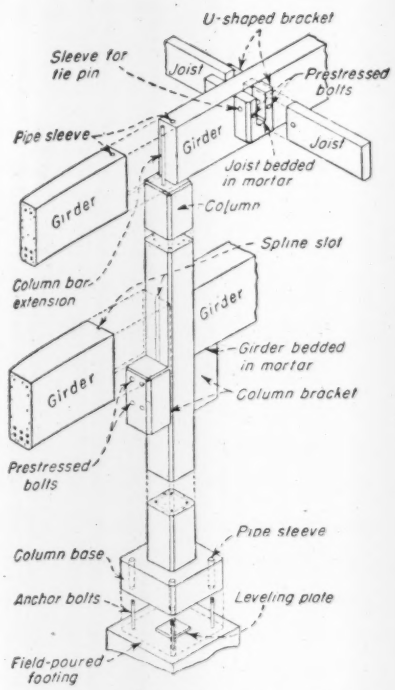

Fig. 2. Isometric view of column showing connection details.

hard-grade reinforcing steel, a working stress of 20,000 psi. was assumed.

The floor members were designed as simply supported spans using load-capacity tables made available to the architect by the manufacturer. This simplified the selection of the dimensions and reinforcing of the precast units needed to support the design loads. Foundation and retaining walls were, however, designed in the usual way and constructed by the general contractor.

Since connections with tolerances much closer than for steel members were required, shop drawings followed structural steel practice in general. Reinforcing, pipe sleeves and other inserts were shown and billed on the detail sheets. As a consequence of rigid shop control, excellent field results were obtained, every member fitting within the predetermined allowed tolerance.

Beams supported on brackets

The precast columns are 12x12 in. by 27 ft. 6 in. long. Cast integrally with each is a 12-in. thick base, 6 in. wider all around than the column, and pipe sleeves near each corner of the base permit 1-in. round bolts to pass through for anchoring of the member to the foundation.

As shown in Fig. 2, precast concrete brackets are fastened on opposite sides of the column by means of prestressed bolts to form seats for the floor girders. Above the brackets, a slot about 2 ft. long is provided in the column, and a corresponding slot is also formed in the ends of the girders to permit insertion of a spline for holding the girder in place.

Having a solid, rectangular 12x24-in. section, each floor girder is 20 ft. 11½ in. long and supports three 8x12-in. joists on U-shaped precast concrete brackets fastened to the sides of the girder by prestressed bolts. A tie pin passed through the legs of the U-bracket and the joist holds the beam in place.

The roof girders are seated directly on top of the column and are tied in by column dowels passing through a pipe sleeve at the ends of the beams (Fig. 2). Supported in U-brackets on the girders, 4x14-in. roof joists in turn carry precast concrete roof slabs. These channel-shaped roof units are 12 in. wide and 5 ft. long, with a 1½-in. deck spanning 3-in. deep longitudinal ribs. On top is placed 20-year built-up roofing.

The slabs used for the second floor have the same dimensions as those for the roof but are more heavily reinforced. Floors are finished with asphalt tile placed on a leveling mastic less than ½ in. thick.

Units made by mass production

From assembly of the reinforcing for the structural members to final casting, shop fabrication was standardized without restricting to too great an extent the flexibility of the system. The reinforcing was cut, jig assembled and welded into cages, together with all necessary pipe sleeves and other required inserts.

Forms for the structural members are all of adjustable steel construction. They permit variations in dimensions for the girders from 8x8 in. to 16x36 in. in cross section and up to 60 ft. in length; for the columns from 8x8 in. to 16x24 in. in cross section and up to 60 ft. in

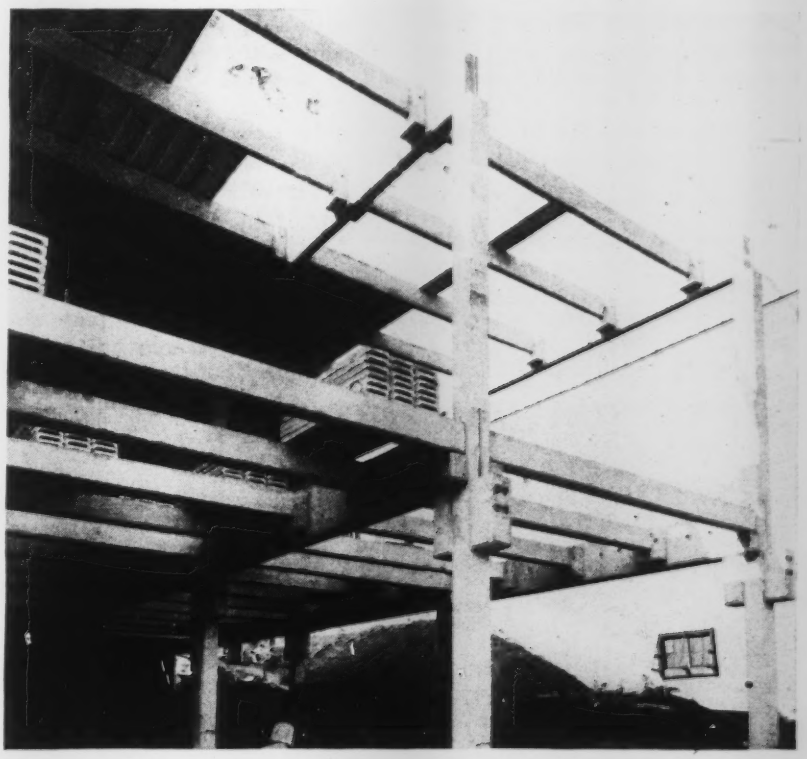

Fig. 3. Precast floor girders, 21 ft. long, are seated on concrete brackets fastened to the columns by prestressed bolts. Roof girders rest directly on top of the columns. The 19-ft. long joists, which support 12-in. wide by 5-ft. long precast slabs, are carried on U-brackets on the girders.

length; and for the joists up to a maximum depth of 24 in. and length of 25 ft.

Because a revolving-drum type mixer was found to be unsatisfactory for the very stiff, rich mixes used, the concrete was produced in a 1-yd. paddle type mixer. High-early-strength cement was used, together with relatively low temperature heating, to accelerate set and permit early removal from forms. After being taken from the forms, all members were wet cured for three days. Standard 7-day cylinder strength varied from 5,500 to 6,500 psi.

Shop handling of all members was by overhead electric traveling crane. Shipments were loaded on trucks directly or by a steam crane from yard storage.

Field erection of the structural frame was completed in 13 working days, using one crew of six men with an 18-ton crawler crane. An additional five working days was required for laying floor and roof panels, cement finishing, grouting, bedding members in at least 2 in. of mortar at supports, filling with mortar the pipe sleeves that fit over the column dowels and setting and packing splines.

Although the precast concrete frame was erected in general very much like one of structural steel, the method of setting columns differs from steel construction in that, when set, these members must be placed true to line and must be plumb.

The structure is claimed to have excellent lateral stiffness as compared to ordinary steel construction, despite the fact that it is not continuous as far as frame action is concerned.

The building was designed by A. H. Rousseau and Bernard H. Lawson, architects, and the general contractor was Landau Construction Co. The Cemenstone Corp., Neville Island, Pittsburgh, fabricated and erected the structural frame and the precast floor and roof units according to their system of construction. Owners are Lowe and Campbell, regional agents for the Wilson Sporting Goods Co.

Main Water Supply Connection Made With Minimum Shutdown

Two large diameter water supply lines serving the city of Tacoma, Wash., were connected recently with only a 36-hr. shutdown of the supply functions of the larger line. Until this connection was made, only one line, 39 in. in diameter, crossed the Puyallup Valley bringing water by gravity from the Green River. A new 39-in. line was installed to provide two lines crossing this valley with added capacity and safety of operation.

So dependent was the functioning of the distribution system on the existing line that the time out of service for making the connection had to be kept to a minimum. Accordingly, instead of the usual method of prefabricating the complete Y connection in the shop and shutting down the line for the extended period necessary for installation, all of this work was done in the field. The only work which required a shutdown was cutting out the pipe wall of the existing pipe and doing some finish welding on the inside of the joint.

For the connection in question, the new 39-in. line connected to the old Valley crossing where the pipe was 48 in. in diameter. A doubler plate was welded to the 48-in. line while this line was being operated under normal conditions with a hydrostatic head of some 220 ft. This plate or flange was 1¼ in. thick by 6 in. wide and was prefabricated to accurately fit the outside contour of the larger pipe. It was attached to the 48-in. pipe by the multiple pass electric welding method, all passes being peened to stress relieve except the first and last pass. A seal weld was temporarily made around the inside circumference of the doubler plate to attach it to the shell of the pipe in place so the welds could be given an air pressure test.

The portion of the larger pipe wall which had to be cut out for the final connection was left in place until the shutdown was made. Previous to the shutdown, the new pipeline had been hydrostatically tested, sterlized, and the necessary concrete thrust anchorage was constructed about the Y branch. The concrete was properly cured and the necessary backfilling and soil consolidation was accomplished. The supply line was then shut off, drained, and the blank in the Y cut out.

As a final step the inside circumference of the doubler flange was permanently welded to the shell of the 48-in. line where the wall section had been cut out. In this manner the one and only supply line for the city was out of service some 36 hr. Other standard methods would have required at least a week.

This work was done under the supervision of W. A. Kunigk, water superintendent, and J. A. Kuehl was engineer in charge of construction in the field. C. A. Erdahl is commissioner of the Department of Public Utilities for the city of Tacoma, of which the water utility is a division.

Welding work required to connect a 39-in. water line to a 48-in. section of a 39-in. line was performed while the latter was operating under high pressure.

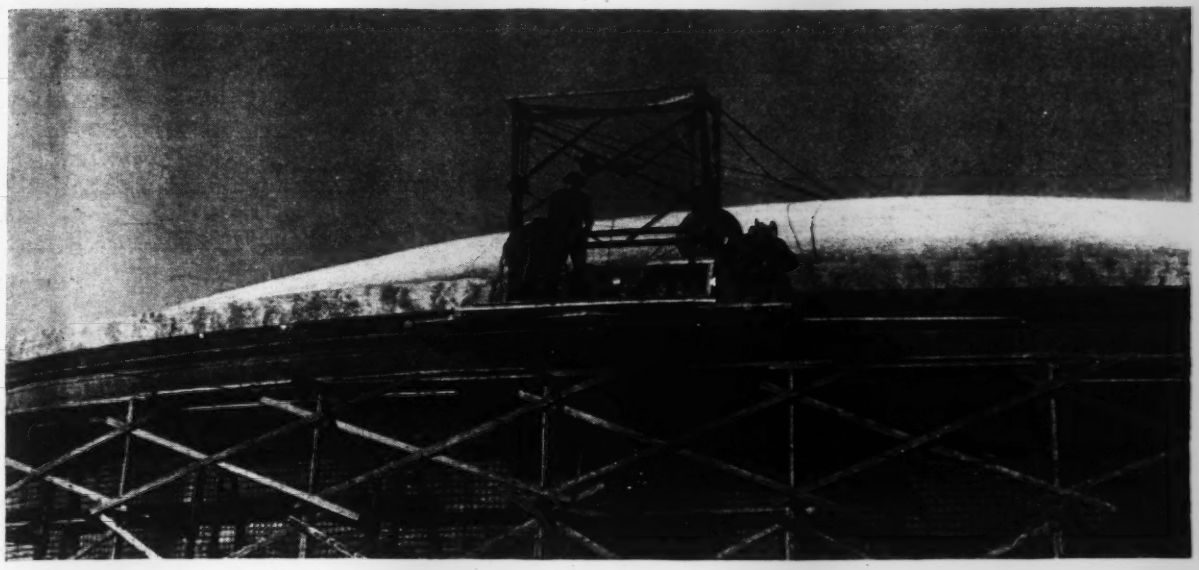

Fig. 1. Prestressing of the ring circumscribing the new 164-ft. diameter concrete dome roof of the Halifax reservoir was performed by a self-propelled wire-winding machine. Wire was applied with an initial stress of 140,000 psi.

Prestressed Concrete Shell Dome Features Rebuilt Halifax Reservoir

R. M. Doull
General Manager, Preload Co., Ltd., and Canada Gunite Co., Ltd., Montreal, Que.

J. D. Kline
Chief Engineer, Public Service Commission Halifax, Nova Scotia

***Contents in Brief**—Repair of weather damage suffered by the 160-ft. diameter, 3½-mg., reinforced concrete reservoir for the city of Halifax, Nova Scotia, involved demolition of the old beam-and-girder roof, restoration of the wall and construction of a 2½-in. thick roof. The latter is believed to be the largest prestressed concrete dome in the world. The main ring was prestressed by means of a wire-winding machine that applied five layers of wire with an initial stress of 140,000 psi. in a continuous spiral. Pneumatically applied mortar was used in wall and roof.*

CONTINUOUS FREEZING and thawing so badly damaged the concrete wall and roof of a 3½-mg. reservoir at Halifax, Nova Scotia, that major reconstruction was necessitated. In addition to extensive wall repairs, the old beam-and-girder roof was replaced, and the new one—164 ft. in diameter—is probably the largest prestressed concrete shell dome in the world. Air-applied mortar, or gunite, was used for the repairs and roof construction.

In 1913, this reservoir was built on an exposed site on Hungry Hill, highest elevation available in the city to provide storage capacity as well as improve pressure conditions in the higher areas. It was designed as a reinforced concrete structure, 160 ft. in inside diameter, 25 ft. deep, with foundations carried down about 8 ft. below grade and heavily reinforced. The floor consisted of a 6-in. slab cast over a compacted fill, monolithic with the footings, and an overlying 6-in. reinforced concrete slab cast in place after the wall and roof columns were built.

The wall was 3 ft. thick at the bottom, tapering to 18 in. at the top (Fig. 2). Placed in 3-ft. lifts, with a ⅜ x 4-in. water stop in each joint, the wall contained a mass of reinforcing steel in two concentric layers, 4 and 6 in. behind the inside and outside faces, respectively. Vertical steel was wired to horizontal bars, which rested in individual chairs bolted to vertical structural frames. An idea of the quantity of steel employed may be had from the fact that in the bottom 11 ft. of the wall there were eighty-eight 1¼-in. dia. horizontal bars in addition to vertical steel, frames, struts and water stops. To a very material extent, the close spacing of the steel and the structural frames contributed to the eventual failure of the wall.

Columns supported old roof

The roof was built as a very flat cone with barely enough slope to provide for drainage. It consisted of a 4-in. slab carried on a series of 12 x 20-in. radial concrete girders and cross beams of various sizes and spans, in turn supported by the wall

and fifty-three 18x18-in. concrete columns. Each girder was haunched into the walls at the outer ends and heavy caps attached them to the columns.

Disintegration caused by weather

During recent years, the Hungry Hill section was only partly developed and there was little protection from the elements. In Nov. 1917, the Halifax explosion, occurring a scant half mile away, blasted every tree and house in this area, affording the reservoir less protection than ever. Again, in 1945, the ammunition magazine in Bedford, a few miles to the north, caught fire and shook the city with a series of violent explosions, but little apparent damage was suffered by the reservoir. The weather, however, was not so kind.

Very little maintenance work was done on the reservoir after completion to correct troubles as they appeared. Some cast-in-place concrete patches were installed on the exterior of the wall, but they were not effective and only served to cover up the real trouble for awhile.

In 1945, when the Public Service Commission took over the administration and operation of the Halifax water system, the reservoir came up for critical inspection. The commission's engineers uncovered the following:

The roof was near the point of complete failure; portions had already fallen into the reservoir and the slab had pulled away from the wall in places. Most of the supporting beams and girders had failed completely in shear. However, except for fractures in a number of the caps, the columns appeared to be in fairly good condition.

The floor could not be inspected because no provision had ever been made to completely drain the reservoir, and about 10 in. of slime and muck covered it under the water that remained.

Completely around the inside of the wall, a band about 4 ft. wide, 15 ft. above the floor, was so badly eroded that the interior layer of reinforcing was exposed, a condition probably aggravated by ice action since the area was located at about normal water level. It was also evident that construction joints were open in many places.

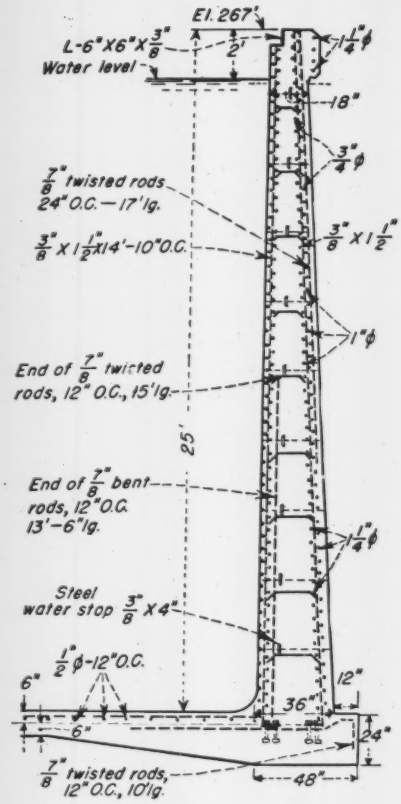

Fig. 2. Section through reservoir wall shows original construction. Horizontal bars rest in chairs on vertical frames.

Fully 50 percent of the exterior wall areas above grade was heavily spalled. Large sections of the wall had fallen off in blocks about six inches thick and much of the reinforcing steel was exposed, had fallen to the ground or was bent out at various angles. Concrete thus bared was soft, in places resembling piles of loose gravel held in place by the reinforcing.

The connecting gatehouse was generally in the same condition as the rest of the structure, but spalling did not appear to have penetrated so deeply.

Actual test measurements disclosed that, in spite of the bad conditions, very little water was being lost. Test pits around the outside of the wall confirmed this and showed almost no disintegration in the wall below grade.

Reasons for the disintegration were fairly clear. Water had gradually seeped through the construction joints, and continuous freezing and thawing had set up local pressures that were sufficient to cause spalling. Some of the reinforcing bars in the wall were bonded to the spalled sections and were bent or torn away as the shell broke off.

Time element forced repair

The Public Service Commission was faced with the problem of repairing the old reservoir or building a new one. In the latter case, the structure had to be demolished, since this was the only available site. Reconstruction was finally selected because time was an essential factor, this reservoir being required for the efficient operation of the water-supply system.

The commission issued a general specification, photographs and plans of the structure and called for competitive bids. Each contractor was requested to submit his own detail drawings, an outline of the method he proposed to follow, a complete specification and guaranteed time schedule.

The low bid thus obtained was over $20,000 less than the next lowest tender and led to the award of a $78,350 contract. Beside this important saving, there were a number of original features in the specifications of the low bidder, such as an increase in the capacity of the reservoir by 500,000 gal., with the head raised 4 ft.; repairs made by guniting; and substitution of a new, prestressed concrete dome for the old roof.

Work started May 15 with Nov. 15 as the completion date. It fell into three distinct phases: Demolition of the old roof, restoration of the wall, and construction of the new dome. Although each of these divisions are described separately in the following, they were carried out simultaneously in the field.

Air-motivated tools

Equipment played an important part in the method specified for the repairs. The main power was compressed air, furnished by two 365-cfm. compressors driven through V-belts by 75-hp. electric motors. Air lines were piped to various points on the job.

Included in the equipment were standard paving breakers for heavy demolition, six tools of a new design for the bulk of the chipping and

cutting; drills, power saws, air hoists and a wire-winding machine for prestressing. In addition, an electric mixer, specially fitted for the dry gunite mix, fed two cement guns through screens and gravity hoppers. Each gun was equipped with modern, dual-hydration nozzles for shooting all the mortar, including the dome roof and its massive ring section.

The first part of the job was the removal of the old roof using heavy paving breakers. To save unnecessary handling and to eliminate the necessity of hoisting, jumbos mounted on wheels were erected inside the reservoir with a heavy wood platform on top at an elevation just sufficient to clear the underside of the beams. The breaking was then done over the top of these platforms and the rubble shovelled into buggies, wheeled across the roof and dumped down a chute into trucks for disposal.

The columns were not removed. Since these members displaced only 12,000 gal. only the caps were cut off and the top grouted over.

Wall rebuilt with gunite

Chipping of the interior wall began as soon as it was considered safe while roof demolition was proceeding. To facilitate this operation, movable pipe scaffolds were used in the early stages, but built-in-place wood scaffolds were gradually erected around the wall since these later also formed part of the supporting structure for the dome forms.

All cracks and construction joints were cut out to a depth sufficient to insure a proper seal and bond. The wall was thoroughly cleaned and all loose surface material was removed by water-blasting and sandblasting. Steel anchors were set in the concrete at about 30-in. centers in each direction and the entire area covered with electrically welded 6x6-in., No. 6, steel wire mesh secured to the anchors.

Immediately prior to guniting, the surfaces to be treated were sprayed with water. Then, the mortar was applied in two or more successive layers to build up the minimum thickness of 1½ in. required for the interior of the wall. The final coat was screeded with straight edges to secure an even surface and then finished with wood floats. At the joint between the wall and floor, a key was cut, subsequently filled with gunite and built out to a substantial cove as insurance against leakage.

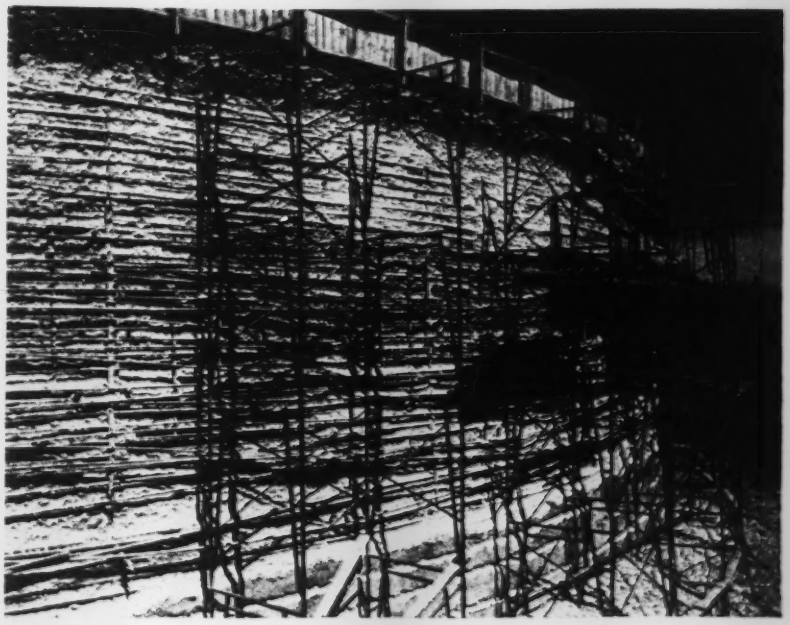

Fig. 3. Defective concrete on the exterior wall of the reservoir was chipped away and badly displaced reinforcing reset. Only the construction joints had to be cut on the part that had been below grade.

The floor, after cleaning, was found in excellent condition and no repairs were required. A sump was installed, however, and connected with a drain under the wall to the outside street sewer.

The outer wall shell was found very porous, was not bonded to the inner portions and fell away quite readily. In some cases, chipping was carried out to expose the new gunite on the

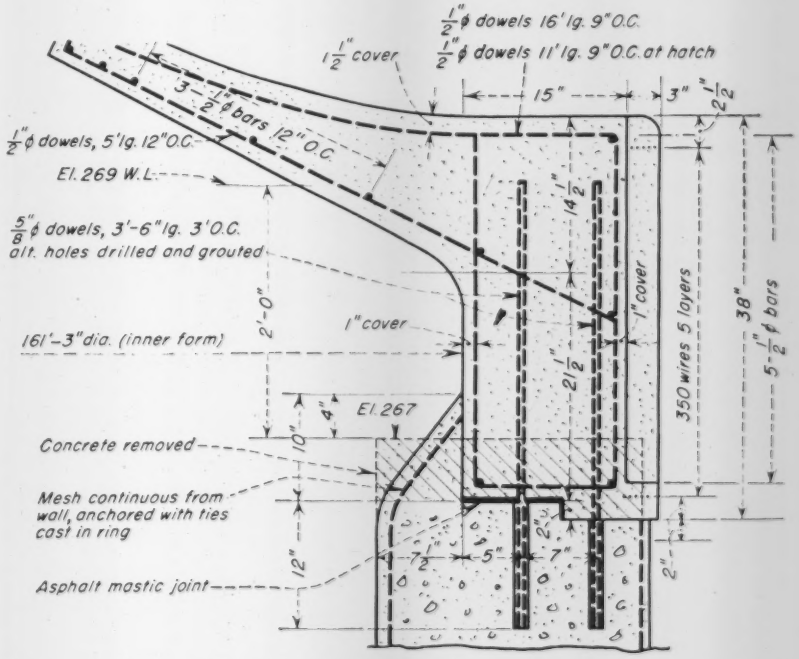

Fig. 4. Connection of the new dome ring to the old wall was complicated by prestressing and water tightness requirements.

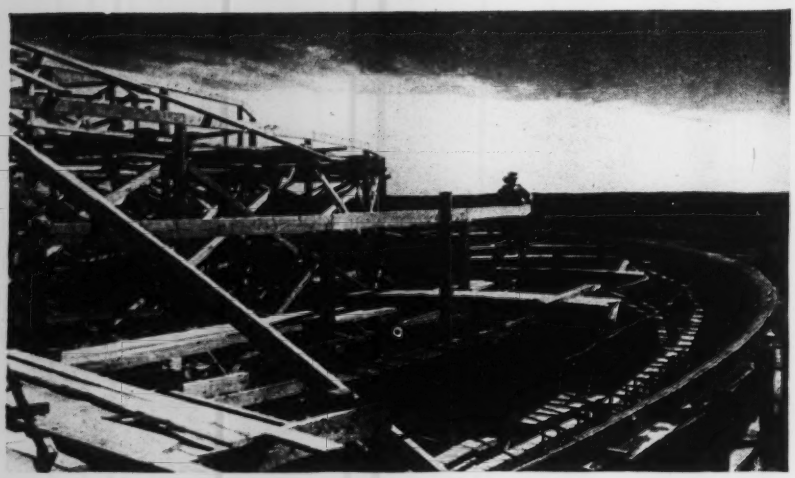

Fig. 5. Forms for the dome rested on concentric posts connected by cross ties that supported radial ribs (left foreground). Ring forms are visible at the right.

inside. The badly displaced reinforcing had to be reset and wired in place (Fig. 3), after which it was thoroughly sandblasted.

The outside of the wall was also sand- and water-blasted before a heavy base coat of gunite was shot to fill the deep holes and bond the old steel. Steel hooks were then placed over the entire wall, 4 x 4-in. No. 4, reinforcing mesh was secured to the anchors and the mortar was applied in two coats, screeded to line and finished with wood floats.

In the meantime the walls had been excavated to the footing. The concrete below grade was found in excellent condition and only the construction joints were cut out.

Gatehouse repaired and remodelled

The gatehouse was gunited inside and out in the same manner as the reservoir proper. Existing floor and walls, however, were too low to accommodate the increased water level. It was necessary, therefore, to raise the upper part and build a new floor, because the water level within the gatehouse is the same as that in the reservoir. Since there was sufficient headroom, this work was completed without raising the roof. The exterior was remodelled somewhat, glass-block windows installed and a steel platform and ladder substituted for the old concrete walkway and stair.

Plans for the new dome roof called for an out-to-out diameter of 164 ft. 3 in., with a shell 2½ in. thick on a radius of 171 ft.

Obviously, such a shell develops, from its own deadweight plus any live load that may be imposed, tensile stress in the ring as well as shear and bending stresses in the shell itself. To make a thin shell possible, the concrete is assisted in carrying the load by standard steel reinforcement and by prestress in the circumferential main ring. The prestress is designed to induce sufficient compressive stresses to reverse the tensile stresses set up in the ring and shell under the maximum load condition. The bending and shear stresses, which are largest near the ring, are compensated for by means of standard steel reinforcing and by thickening the shell.

A comparison of the dome with the beam-and-girder roof shows 300 cu. yd. of gunite and 27,000 lb. of steel in the new structure as against 590 cu.yd. of concrete and 60,000 lb. of steel in the old, including the columns.

Dome-seat problem solved

Seating the dome on the old structure was the first consideration requiring particular attention, since it was necessary to develop a positive connection. It was recognized that some movement would take place in the ring as the compressive forces of prestressing were built up, but at the same time, the joint must be watertight from the inside under hydrostatic pressure.

To solve this problem, the top of the old wall was cut down to the required elevation, levelled off and a key cut to form a joint (Fig. 4). The inside half of the joint was coated with ¼ in. of asphalt mastic to prevent bonding, and after prestressing, the interior intersection was covered by overlapping the gunite wall lining and bonding it to the ring.

Formwork for dome

First step in the construction of the roof was to erect a tower in the middle of the reservoir to set the center point. Since the old walls were not truly circular, an average was taken to establish this working point.

Ring forms were prefabricated on the ground in sections and set in place by instrument. A full form was used on the outside (Fig. 3) but on the inside the form was built up to the springing line of the dome only.

Dome forms were carried on a series of posts set at 10-ft. centers in concentric rings (Fig. 5). Cross pieces were fastened across the tops of the posts at predetermined elevations to support radial ribs that were cut to the correct curvature, set with wedges to permit adjustment for final setting and sheeted over with light form lumber. A series of contours were run by instrument to check and adjust for curvature.

The main reinforcing in the shell was an electrically welded 6x6-in., No. 6, steel-wire mesh weighing about 421 lb. per hundred square feet. The mesh was supported on the forms by small chairs to locate it in the middle of the shell. Special reinforcing was used around the manway and ventilator to transmit the stresses at these openings.

The ring was gunited and allowed to set for several days before mortar for the shell was applied. To some extent, this procedure eliminated transmission of shrinkage stresses to the shell.

The dome was then shot in a continuous operation, with two 12-hr. shifts, each using two cement guns, working for 5½ days (Fig. 6). Following the nozzlemen, cement finishers with special screeds wood-floated the gunite to a smooth surface.

Curing was an important consideration. During the actual shooting operation, the gunite was kept wet using hose and sprinklers. Later, a perforated circular pipe was placed around the ventilator curb and water allowed to flow over the dome continuously, supplemented by revolving

sprinklers. The dome was cured for two weeks before the prestressing operations commenced. Compression tests of the air-applied mortar showed strengths well over 4,000 psi.

Ring prestressed by machine

Prestressing was done with a high tensile strength wire specially developed for this class of work. This wire was 0.162 in. in diameter in its initial state, with a yield point exceeding 180,000 psi. and an ultimate strength over 220,000 psi. It was wound on the ring with a stress of about 140,000 psi., the high stress being necessary to allow for losses due to shrinkage and plastic flow in the gunite and creep in the steel. In the design, a working stress of 110,000 psi. was assumed. Thus, provision was made for a total loss of 30,000 psi. from all causes. This is believed to be on conservative figure and is borne out by experience in the field and tests made in the laboratory to check the computations.

The wire-winding machine (Fig. 1) was set on a working platform hung from a supporting carriage that traveled on a pneumatic tires around the ring. Tie cables attached to a pin extending through the center of the dome held the carriage to its track. The rig was propelled at about 3 mph. by a gas engine installed on the working platform. The engine operated a drum that engaged an endless wire rope passing around the perimeter of the structure. A spring-loaded take-up was provided to maintain the tension required for proper traction. Vertical travel of the mechanism was obtained by hand wheels operating a simple winch device.

Carried on a reel mounted on the working platform, the wire was fed to a die of predetermined size through which it was drawn to develop the required stress. Winding started at the bottom of the ring from an anchor set in the gunite, and each coil was jointed to the following roll by means of a special torpedo splice.

Five layers of wire were applied in continuous spirals and each layer was bonded in immediately with a thin coat of gunite. The next layer was installed after the coat had set. The final layer was covered with about 1 in. of gunite for permanent protection. Two layers of wire were also wound on the remaining part of the old ring to induce some measure of prestress in this part of the structure and to assist in the transmission of stresses from the new work to the old.

The entire outside surface of the reservoir was finished with a white-cement brush coat, and fill was placed against the outside of the wall to a height of 15 ft. above the original grade. Next year this will be graded and seeded, and the adjacent property made into a scenic park, with benches and flower beds improving a once desolate Hungry Hill.

R. M. Doull supervised construction for the contractors, the Preload Co., Ltd., and the Canada Gunite Co., Ltd., with J. D. Kline in charge for the Public Service Commission of Halifax. The prestressed shell dome was designed by the Preload Corp. in New York City.

Fig. 6. Two cement guns were used in guniting the wire-mesh reinforced concrete dome of the Halifax Reservoir. The work was carried out as a continuous operation using two 12-hour shifts and working five and one-half days.

PROCEDURE FOR OBTAINING GUNITE SAMPLES

To procure a typical sample of the mortar used in repairing the Halifax reservoir to test for compressive strength, the following method was used:

A 2x12-in. by 6-ft. long board was placed horizontally and gunited to a thickness of 4 in. or more. After the slab had taken a firm initial set, usually after about one hour, the mortar was trimmed inward from the edges of the board to a distance of about 1 in. to permit placing 4-in. screed boards. These boards were used as guides for cutting the top surfaces of the mortar by means of sharp-edged tools to form a plane parallel to and 4 in. from the bottom of the slab. Then, a 4-in. diameter, 6-in. high steel cylinder was used to mark out specimens about 8 in. c. to c. along the center line of the top surface of the slab.

The gunite was troweled away outside of the circular markings until specimens slightly more than 4 in. in diameter were obtained. Set on top of a specimen, the steel cylinder was used as a vertical guide for a cutting spade operated vertically to shave the specimen to true dimensions using the cylinder as a guide. About 8 in. long, this tool had a sharp lower edge, a width equal to one half the circumference of the cylinder and a curved shape to fit the surface of the cylinder. After being formed, the specimens were immediately covered with burlap and kept thoroughly moistened for a period of 12 hr., after which they were immersed in water or otherwise cured.

Modified Activated-Sludge Plant Replaces Imhoff Tank Installation

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***Contents in Brief**—Philadelphia has begun construction of a sewage treatment plant to replace an existing Imhoff tank installation serving the northeast drainage district. The modified-aeration activated sludge process in which air will be supplied at the rate of 0.4 cu. ft. per gallon of sewage will be employed. Sludge will be heated to 110 deg. prior to its introduction into digestors where a temperature of 85 deg. will be maintained. Each digestor will be fitted with devices to combat scum formation. Supernatant liquor from secondary digestors will be aerated and returned to the raw sewage inlet. On the basis of an average daily flow of 125 mgd., 75 percent removal of biochemical oxygen demand is expected.*

THE FIRST STAGE of Philadelphia's comprehensive sewage disposal improvement plan has gotten under way with reconstruction of the Northeast sewage treatment works. This Imhoff tank installation—built in 1918—will be supplanted by a 125-mgd. modified activated sludge plant. This latter will make use of existing screens, grit chambers and pumps, but the Imhoff tanks must be abandoned because of severe disintegration of concrete.

Featured in the plant's design is the use of modified aeration as well as facilities for preheating sludge.

With the modified-aeration process, air will be supplied at the rate of 0.4 cu.ft. per gallon of sewage and at pressure high enough to fragmentize solid matter and obtain intimate mixing. Sludge processing calls for preheating the material to 110 deg. F. and charging of the digestors at regular 2-hr. intervals.

Based on an anticipated 1970 population of 876,000, the design provides for an average flow of 125 mgd. and a maximum of 200 mgd., the latter being 160 percent of the average. Completion of collecting sewers during the next three years is expected to bring the present flow up to 91 mgd.

Included in the plant are: Coarse screens, grit chambers, low-lift raw sewage pumps, primary settling tanks, aeration chambers, final settling tanks, sludge digestors, supernatant aeration tanks, a blower building, a gas holder and digested-sludge lagoons.

Of the existing installation only the screens, grit chambers and raw sewage pumps will be incorporated in the new plant. The screens are of the sloped, bar type; the grit chambers are equipped to remove sediment continuously, and the pumps will be used to lift desilted raw sewage to primary settling tanks.

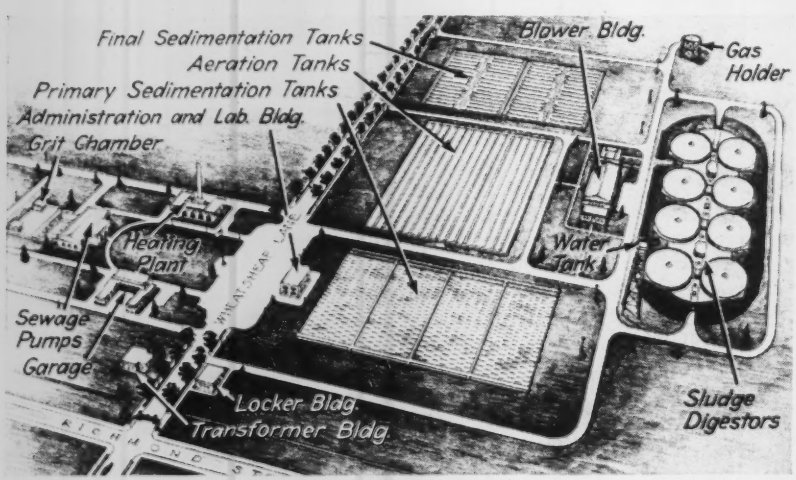


Fig. 1. Philadelphia's new Northeast sewage treatment works will present this view to airplane travelers.

Primary sedimentation tanks

To divide raw sewage uniformly among four primary settling tanks, the influent channel includes twelve branches on one side so that three serve each tank. From the beginning to the end, the area is reduced gradually not only by a decreasing width but also by an upward sloping bottom. Each branch is subdivided into two conduits providing six entrance ports per tank.

In each channel inflow is controlled by a regulating plate, 30 in. high by 15 in. wide, operating under water, with the top edge about a foot below the surface. Nine locking positions are provided in an operating arc of 112 deg. As some maintenance is expected, easy access has been provided to expedite cleaning.

Entrance baffles will provide for further distribution of flow across the cross-sections of tanks.

From the seven channels into which each of the four primary settling tanks are divided, sludge will be removed by means of longitudinal and transverse scrapers. In addition, return flights of longitudinal scrapers will

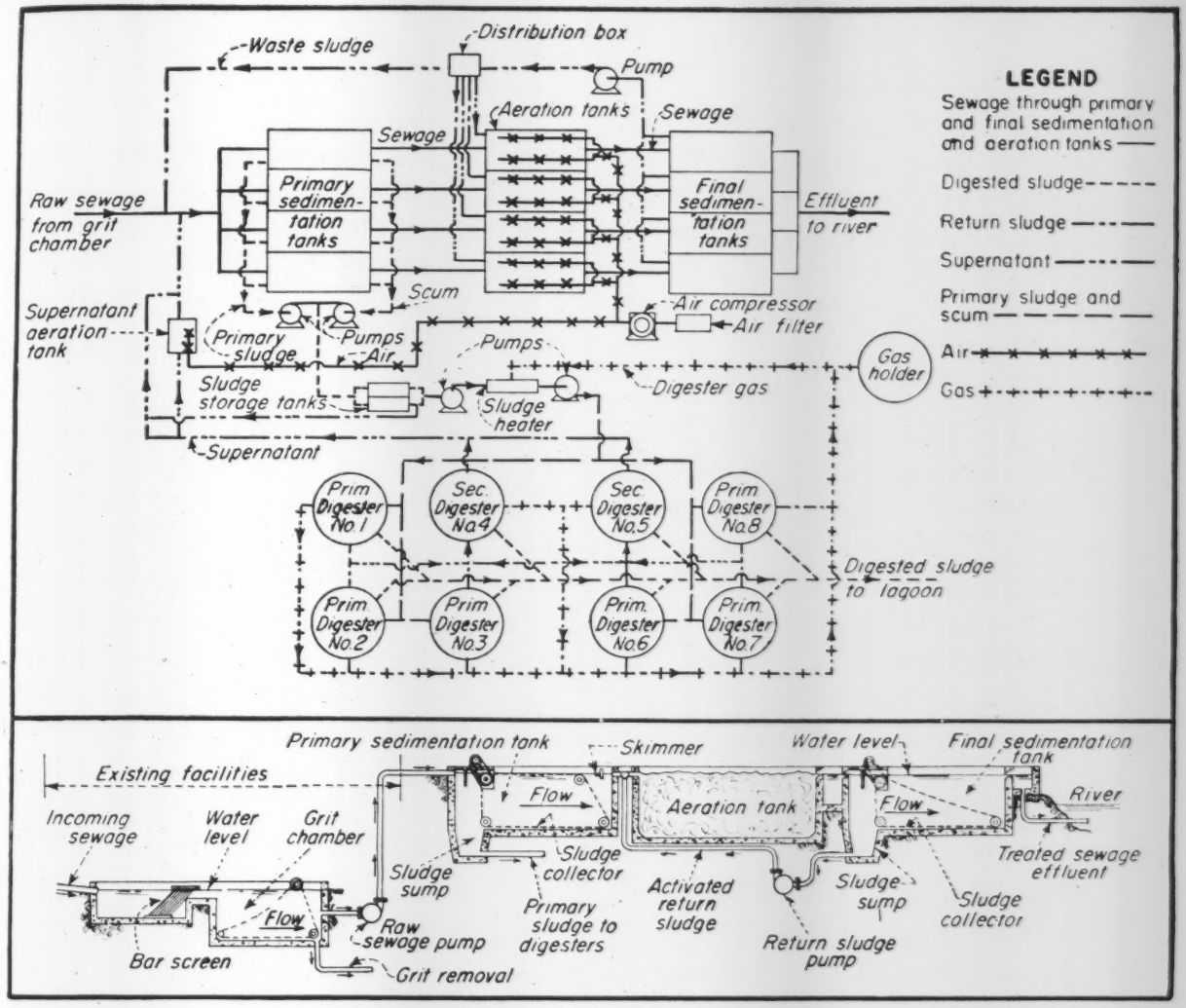


Fig. 2. After primary settling, the liquor is aerated, resettled and discharged to the river. Collected in primary units, sludge is stored, heated, fed to primary and secondary digestors in sequence, and disposed of in lagoons.

carry scum to the effluent end of tanks for collection by transverse skimmers and discharge into tilting buckets located on both sides of the tanks. Scum will be piped from the bottom of buckets to intermediate sludge storage tanks.

It is anticipated that sludge will be returned from final to primary tanks in the amount of 10 mgd. or about 8 percent of the design capacity. Primary sludge will be pumped to intermediate storage tanks, from which it will be withdrawn in measured quantities, heated, and forced to digestion units. This sludge, it has been estimated, will amount to 450,000 gpd. and contain 96 percent of water.

Corrosion-resistant concrete made from calcium aluminate hydraulic cement and select inert aggregates will be used for those parts of the influent channels and primary settling tanks above the water line. For additional protection, a complete band of vitrified clay plates will be placed at and above the water line in all tanks.

Each tank will be fitted with a 12-in. pipe which will drain the unit in about 20 hr.

Aeration tanks and fittings

Each of the four aeration tanks will be subdivided into four channels with influent and effluent devices located at opposite ends of the units. These channels will be formed by a longitudinal wall on the centerline and by two parallel Y-shaped partitions on the quarter points that will contain air supply piping and support diffuser-tube assemblies on both sides.

The cast-iron trunk main located in the top of the partition will vary from 18 in. at one end of the tank to 8 in. at the other. Diffuser assemblies (Fig. 3) will be connected to the line by means of special crosses placed at 25 ft. 7 in.-centers in the trunk line.

Diffuser tubes, 3 in. in diameter, spaced 12-in. on centers, and offset 6 in. on opposite sides, will be supported on a cast-iron holder, 12 ft. long and 8 in. in diameter, by means of bolts extending through the holder and tube as shown in Fig. 4.

To guard against corrosive fumes and liquids, vitrified clay plates will be placed at the water line, and all concrete surfaces above the plates, except walkways, will be coated with bituminous compound.

DESIGN AND ENGINEERING DATA FOR THE NORTHEAST SEWAGE TREATMENT PLANT, PHILADELPHIA, PA.

Treatment: Coarse screening, mechanical grit removal, low-lift pumping (all from present plant), primary sedimentation, aeration, final sedimentation, storage for withdrawn sludge, external sludge heating, two-stage sludge digestion, supernatant aeration, gas collection for heating of sludge, lagooning of digested sludge.

Capacity: 125 mgd. average (142.7 gal. per capita per day) from a population of 876,000 anticipated in 1970. In a serviced area of 82,940 acres, this is equivalent to 10.6 persons per acre. 200 mgd. maximum, or 160 percent of the average.

Sewage Characteristics: 200 ppm. suspended solids and 200 ppm. 5-day biochemical oxygen demand. (These figures are slightly higher than found in samples taken over a period of years and provide a factor of safety.)

Screens: Curved, bar, automaticlly cleaned, with 1½-in. spaces.

Grit Removal: Five channels, 60 x 14 x 17 ft. Flowing-through velocity, 1 fpm. Grit removed by a screw conveyors and pneumatic ejectors.

Raw Sewage Pumps: Six units, two rated at 22,000 gpm., two at 12,000 gpm., and two variable speed pumps with capacities varying from 2,000 to 12,000 gpm. No check valves. Lift, 25 to 35 ft. Provisions have been made for the installation of six additional pumps.

Primary Sedimentation Influent Channel: One conduit with 12 branches, three to a tank. Each branch subdivided to provide six entrance ports per tank.

Primary Sedimentation: Four tanks with seven channels per tank, each channel being 250 x 17 x 10 ft. Average velocity at 125 mgd. 2.5 ft. per min. Liquid volume 1,250,000 cu. ft. Settling rate about 1,000 gal. per sq. ft. per 24 hrs. Continuous sludge and scum removal.

Aeration: Four tanks, each subdivided into four channels, 410 x 21 ft. 9 in. x 15 ft. Liquid volume in four tanks, 2,025,400 cu. ft. Displacement period of mixed liquor with 16 percent return sludge at 125 mgd., 2.5 hrs.

Air: Blower building. Two 10,000 cfm. and one 13,000 cfm. positive displacement blowers operated by synchronous motors. One 16,000 cfm. centrifugal blower operated by squirrel cage, induction motor. Total air capacity, 49,000 cfm. Design rate 0.4 cu. ft. per gallon of sewage. Two electronic air filters.

Final Sedimentation: Four tanks, each subdivided into four channels, 112 ft. 10 in. x 18 x 13 ft. Total liquid volume 1,648,000 cu. ft. total surface area, 127,232 sq. ft. With 16 percent return sludge, the settling rate will be 1,140 gal. per sq. ft. at 125 mgd. and the displacement period, 2 hr. Flowing-through velocity (assuming uniform cross-sectional distribution), 0.94 ft. per min. Total effluent weir length, 9,400 lin. ft. giving one lin. ft. per 13.5 sq. ft. of surface area.

Intermediate Sludge Storage: Two tanks, 14 x 12 x 54 ft.; total capacity, 18,036 cu. ft.

Sludge Heating: Direct heating process to 110 deg. F. to maintain a digestor temperature of 85 deg. F. for a quantity of 450,000 gpd. With an incoming temperature of 48 deg. F. and assuming some 8.5 million Btu. per hr. at 85 percent efficiency, 19,700 cu. ft. per hr. of sewage gas will be required. Expected quantity of gas, 33,300 cu. ft. per hr.

Sludge Circulating: Two variable-speed trash pumps rated at 325 gpm. each.

Sludge Digestion: Six primary and two secondary digestion tanks, 110 ft. in dia. and 32 ft. high (sidewall). Each tank will have a floating cover and an inverted conical bottom. With a freeboard of 2 ft., each tank will have a liquid volume of 283,000 cu. ft. (2,125,000 gal.) giving 2.59 cu. ft. per capita in eight tanks for 876,000 persons. On the design basis of 75 percent removal of suspended solids, the loading will be 2.07 lb. per cu. ft. per month.

Cost: About $8,500,000.

Activated sludge drawn from final settling tanks will be temporarily stored in a distribution box. A maximum amount of 16 percent of the rated capacity will be returned to the aerating units through 20-in. cast-iron pipes, and the excess will be carried back and retreated with raw sewage.

Drainage will be obtained by means of 12-in. sluice gates opening into a canal connected to the sewer. About 10 hr. will be required to empty one tank.

Final sedimentation tanks

Each of the four final settling tanks will be divided transversely into sixteen channels, fitted with three effluent troughs, one on each side of the channel extending from a point 30 ft. beyond the inlet to the outlet end, and the third, transversely-connecting the side collectors, 30 ft. from the outlet.

As with the primary units, sludge will be collected in each channel by means of a longitudinal scraper moving at the rate of 2 fpm. to a receiving canal. Here another unit moving transversely will push the material to the withdrawal sump.

These tanks will be drained by sixteen 12-in. sluice gates, four to a tank, so spaced that each gate will control four flowing-through channels. About 10 hr. will be required to drain one tank.

Sludge digestion tanks

Eight circular sludge digestion tanks with floating covers and inverted conical bottoms will be built. Operating in batteries of four, each battery will consist of three primary and one secondary digestors. Space has been allotted for four additional tanks adajacent to those now being built.

Operation of primary digestors will be intermittent. The 12-hr. cycle will include: a 2-hr. charge; a 6-hr. rest; supernatant decantation for one hour; a rest period of one hour; and sludge withdrawal during the eleventh hour; and a final one-hour undisturbed interval.

Drawn from the intermediate storage tanks as needed, sludge will be pre-heated by means of gas-fired units to 110 deg. F. Then, it will be pumped to the digestors where a temperature of 85 deg. F. will be maintained with a daily injection of 450,000 gal. Digested sludge drained to lagoons.

Two sludge circulating pumps (one standby) will be provided for each digestor battery. Piping has been planned so that heated sludge can be mixed with supernatant and the mix-

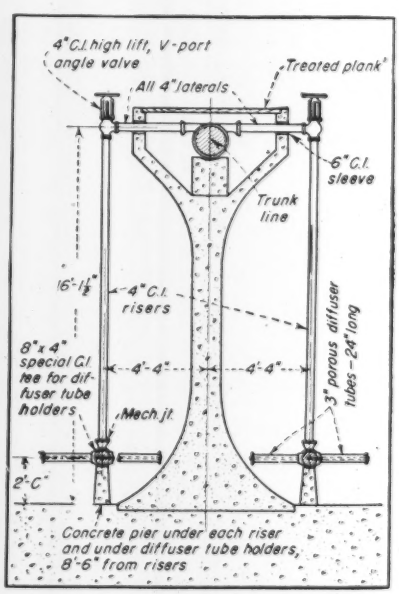

4" C.I. high lift, V-port angle valve
Treated plank
All 4" laterals
6" C.I. sleeve
Trunk line
16'-1½"
4" C.I. risers
8" x 4" special C.I. tee for diffuser tube holders
4'-4"
4'-4"
3" porous diffuser tubes – 24" long
Mech. jt.
2'-0"
Concrete pier under each riser and under diffuser tube holders, 8'-6" from risers

Fig. 3. From the trunk line, air is carried down to the diffuser assembly through valved risers spaced 25 ft. 7 in. on centers.

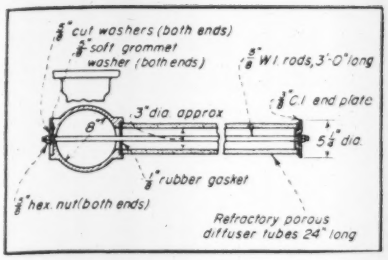

⅜" cut washers (both ends)
⅜" soft grommet washer (both ends)
⅝" W.I. rods, 3'-0" long
⅜" C.I. end plate
3" dia. approx
8"
5½" dia.
½" rubber gasket
⅜" hex. nut (both ends)
Refractory porous diffuser tubes 24" long

Fig. 4. Diffuser tubes, 3 in. in diameter, are fastened to the cast-iron header by means of long bolts passing through the tube and the header.

ture discharged to any primary tank. In addition, sludge liquor can be distributed separately, and digested sludge can be circulated within a tank or passed from tank to tank.

Supernatant selectors used

Primary and secondary digestors will be equipped with one and three valved supernatant selectors respectively. Primary liquor will be fed intermittently to secondary tanks, but secondary liquor will be drawn off continuously and discharged either to the aeration tank or directly to incoming raw sewage.

Recirculated supernatant, discharged one foot below the top of the layer, will be used to control floating scum. In addition, a water-spray system consisting of four nozzles in the gas dome and operating at 40 psi. will be provided.

Compressed air facilities

The blower building, construction of which will be started before the end of 1947, will house the blowers, air filters, sludge heating equipment; return sludge pumps and hot sludge pumps.

The main air supply will be furnished by three positive-displacement and one centrifugal blowers. Providing a total capacity of 49,000 cfm. of free air, the unit sizes were chosen to insure flexibility of operation.

Owing to extreme fineness of the pores in diffuser tubes, and their susceptibility to clogging, special provisions have been made to supply clean air. To accomplish this, two electronic air filters, each with a capacity of 46,700 cfm., will be provided.

Known as electro-static precipitators, these cleaners function by ionizing dust electrically and collecting charged particles on plates of opposite polarity. The efficiency of this device varies with the amount of air passing, but at the rated capacity of 46,700 cfm. it removed, under trial, 85 percent dust applied, using the discoloration test developed by the U. S. Bureau of Standards.

To minimize dust and maintain optimum motor temperature, an air conditioning unit will be installed. In addition, the blower room will have a minimum of door and window openings.

Operating results expected

Successful operation of this plant will reduce the biochemical oxygen demand in 125 mgd. from 200 to 50 ppm., the remainder amounting to about 50,000 lb. per day. Assuming that the dissolved oxygen content of the Delaware River will be 6 ppm. and the flow 3,200 mgd. the total available dissolved oxygen will equal about 154,000 lb. per day. Therefore, 104,000 lb. or about 4 ppm. will not be consumed.

This oxygen content is generally enough to support fish life and some of the effluent actually will provide food for fish and sub-aqueous plant life. When other communities along the Delaware River provides similar treatment, the return of fish life, disappearance of the sludge banks and resultant malodorous gases, elimination of the deleterious effects to shipping and the return of safe recreational facilities can be anticipated.

The plans were prepared in the Department of Public Works by the bureau of engineering, surveys and zoning. Thomas Buckley is director of the department, and A. Zane Hoffman is chief engineer and surveyor. Greeley and Hansen of Chicago are the consulting engineers.

Cities Curb Parking Abuses

Major cities are tightening regulation of parking lots to stop the charging of excessive fees and mishandling of cars according to International City Managers' Association.

Ten or more big cities have put stringent parking lot regulations into effect. In addition, the magazine, *Traffic Quarterly*, reports that Buffalo, Kansas City, New York, Oklahoma City, Jackson, Mich., and others are considering rules to prevent parking rate piracy and help improve parking lot service.

Several cities require parking lots to be licensed, and some also require registration and licensing of parking lot attendants. Other cities require that parking lot operators be bonded to protect customers against auto theft or damage. Large signs clearly specifying parking rates are being required in a number of cities.

Parking lot license fees vary widely. In Kansas City, Mo., the fee is $1 per year per car capacity while the Toledo fee ranges from $5 a year for lots 1,500 square feet or less to $35 for lots 6,000 square feet in area. Detroit's fees are $5 per year for lots with 10-car capacity to $40 for 50-car lots or bigger. Parking lot fees in Atlanta range up to $75 a year.

License requirements also vary widely. Detroit provides that no license shall be issued to any person whose license has been revoked in the last five years. In Washington, license applicants must have their lots inspected by the fire marshal and building inspector. In San Francisco and St. Paul, the fire chief must inspect and report on the premises as to fire-prevention measures before a lot can be licensed.

Denver and other cities require parking operators to post parking rates in printing at least six inches high on prominently displayed signs. Where different day and night rates are charged, the change must be clearly posted and may not become effective until 6:00 p.m. Night rates may be charged in Detroit and Grand Rapids after 5:30 p.m., and in Flint, after 7:00 p.m.

To protect customers against theft or damage, Denver requires lot operators to post a $1,000 bond. Detroit has abandoned its bonding requirement for lot operators but provides that the licensee is liable for damage to any car parked in the parking lot. Philadelphia, Toledo, and other cities also have strict provisions for protecting customers' property.

Ten-Story Terrace Plaza Hotel Set Atop Stores Seven Stories High

***Contents in Brief**—With the lobby located on the eighth floor above two department stores, the 18-story Terrace Plaza Hotel Building now under construction in Cincinnati presented many design problems. The structure is to be air conditioned throughout, and part of it is to be windowless. Its frame is structural steel, the floors are concrete slab and joists and the exterior facing is an oversized brick laid with continuous vertical joints. In addition to features normally included in hotels and department stores, provision had to be made in the design for the most efficient column spacing for both types of occupancy, for wind bracing, for off-street delivery, for a basement cafeteria and for a lobby-level restaurant and terrace garden.*

WHEN preliminary studies favored a combined department store-hotel building the owners of a 90x400-ft. site in Cincinnati, Ohio, decided that an investment of about $12,000,000 in an 18-story steel-frame structure to house the two types of occupancy would be justified. The Terrace Plaza Hotel now is under construction, but before it reached this stage, many intriguing design problems had to be solved. These varied in nature from architectural considerations affecting space allocation to structural design aspects of bracing the narrow building against wind, and determining the most advantageous column spacing.

Located on Sixth St. between Vine and Race Sts., in the business district, the edifice is separated from existing structures by 10-ft. wide Thorpe Alley (Fig. 2). The completed building will extend from sub-basements 30 and 50 ft. below street level to more than 300 ft. above, with the lower seven stories devoted to commercial activities; the eighth floor to the hotel lobby, restaurant and terrace garden; and the remainder to guest rooms, except that adjacent to the utility penthouse on top of the hotel will be a small circular dining room. An 8-story, 93x47-ft. annex to the new building has an entrance on Opera Place and bridges the alley.

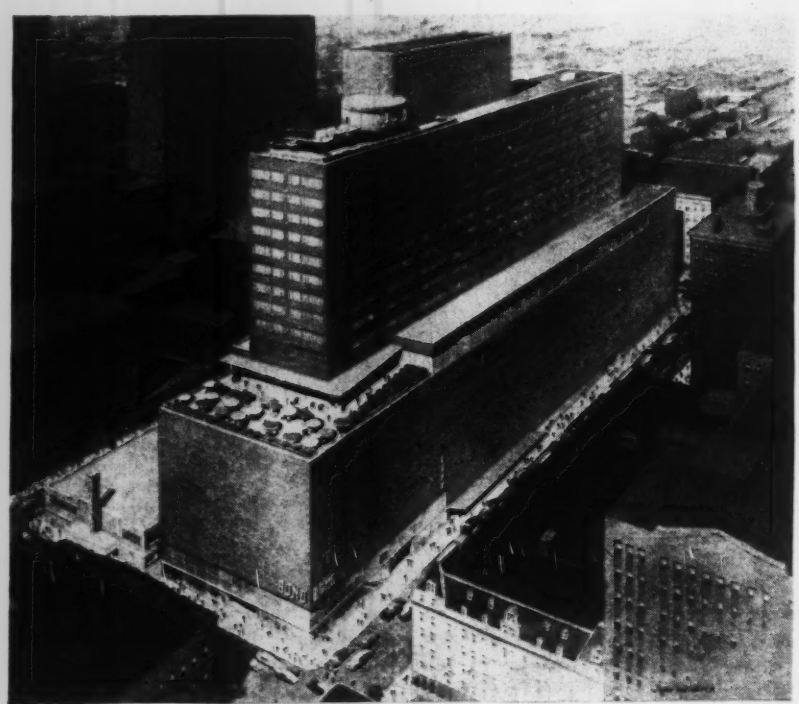


Fig. 1. Terrace Plaza Hotel of Cincinnati occupies the upper portion of an 18-story building, with the lower half devoted to stores.

Effect of air conditioning

The entire building will be air conditioned at a cost estimated at well over $1,000,000. Fed by ducts from six conditioning units located in different sections of the structure, each major subdivision and every hotel room will have independently operated controls for cooling and heating. Three centrifugal compressors with a total capacity of 1,500 tons of refrigeration will be used to supply the cooling units with cold water. Intake air will be cleaned by electrostatic filters, will pass over finned coils through which will flow cold water in summer and hot water in winter, and will be sprayed with water before being forced under high pressure to local units. After discharge from the system, the air will be exhausted without recirculation.

As a consequence of air conditioning, hotel room windows need not be opened except for cleaning or emergency use. Air conditioning also made provision of windows unnecessary in the commercial portion of the building, other than for display needs on the street floor. Thus, from about the second to eighth floors, the structure is windowless, making possible a more effective use of floor space.

Present plans for heating call for the use of gas-fired boilers, located in the sub-basement about 50 ft. below

street grade. Provision, however, has been made for converting to oil, and space will be available for coal storage.

The portion of the building from street level to the sixth floor, at the corner of Sixth and Vine St., has been leased to Bond Stores, clothiers. This store will occupy more than 55,000 sq. ft. of floor space. Part of the sixth and seventh floors above Bond's will be available for offices, showrooms or other uses. Another department store, J. C. Penney Co., occupying a total area of 200,000 sq. ft., will be located at the corner of Sixth and Race Sts. from the basement through the seventh floor.

The area below the Bond store will be devoted to a 400-seat cafeteria operated in conjunction with the hotel and easily accessible from the main entrance of the Terrace Plaza. At about the center of the Sixth St. frontage is a 28-ft. wide hotel entrance and elevator foyer with two banks of four elevators. One bank will serve the hotel lobby and rental space on the sixth and seventh floors and the other the entire hotel, either operating only above lobby level or running express between the street and eighth floors and local above, as desired by the management. These elevators are expected to be adequate since no convention or ballroom facilities are planned. The hotel will also have service elevators. Vertical transportation will be provided in the stores, including escalators in the J. C. Penney portion. The location of elevators and stairs is shown in Fig. 3.

Hotel facilities in upper stories

In accordance with the Cincinnati regulations, the full area of the site could be occupied to a height of about seven stories, but above that, a setback of 1 in 4 is required. To simplify the layout in the hotel, therefore, it was decided to provide a section of constant area above the eighth floor.

At this level there will be located, in addition to the lobby, a 200-seat restaurant opening onto a terrace which can be used as an outdoor skating rink or an outdoor garden.

From the ninth to the eighteenth floors will be situated the 400 guest rooms, all with outside exposure. In addition to 10-ft. wide windows and provisions for regulating temperatures according to individual preference,

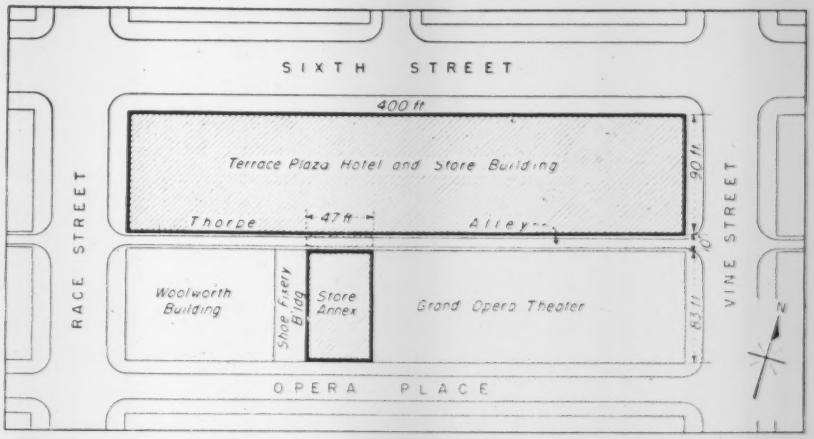
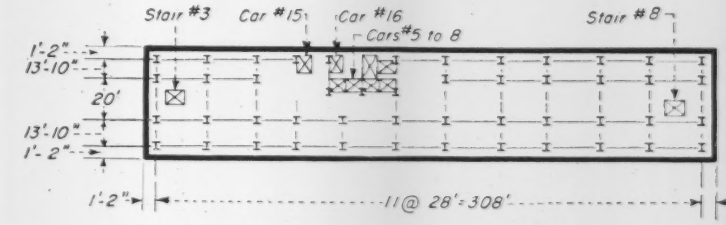
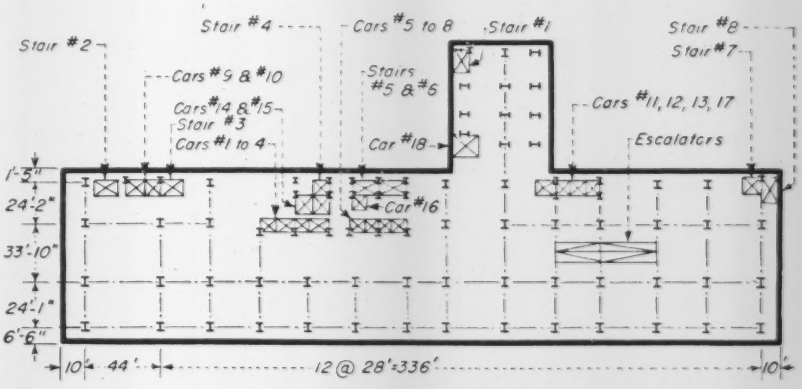


Fig. 2. The new structure occupies a long, narrow site, separated from existing buildings by a 10-ft. wide alley. An 8-story store annex bridges the alley.



PLAN OF TYPICAL HOTEL FLOOR



PLAN OF TYPICAL STORE FLOOR

Fig. 3. Typical floor plans in hotel and store areas indicate location of stairs, elevators and escalators.

the rooms are equipped with many innovations to make them attractive.

The entire building will be faced with Norman-size (2x4x12-in.) brick of terra-cotta color laid in a manner similar to tile with a continuous vertical joint between each panel.

In the design of the superstructure, 2,500-psi. concrete was assumed and the allowable unit stress for steel was taken as 20,000 psi. The floor loads used, exclusive of the weight of partitions, steel and haunches, are shown in the accompanying table.

The floors are concrete slab and joist, with a clear distance between joists of 20 in. (Fig. 4). The slab is $2\frac{1}{2}$ in. thick; in the hotel section joists have an overall depth varying from $7\frac{1}{2}$ to $10\frac{1}{2}$ in., with a width of web of 5 in. In the store area, the 20-in. spacing between joists and the 5-in. width are maintained, but the joists are deepened to $14\frac{1}{2}$ in. In the larger panels, a centrally located distributing joist is used. Floor framing between columns, however, consists of steel beams.

Column loads and foundation conditions are such that the building can

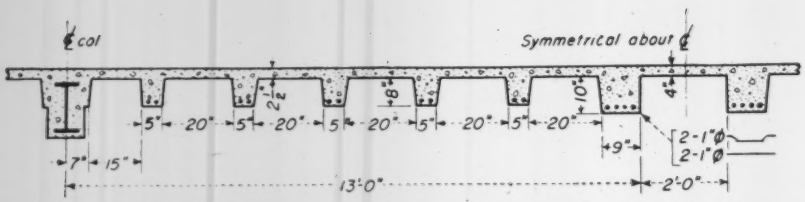


Fig. 4. Typical floor section used from 9th to 10th floors. Concrete slab-and-joist floors are also used in stores.

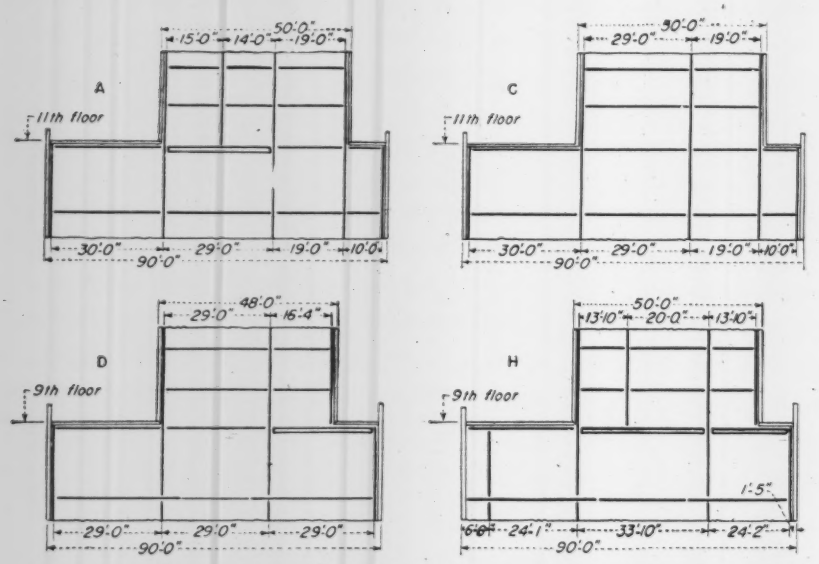


Fig. 5. Some cases studied in determining column location. Scheme A tried small spacing, C eliminated column transfers, D investigated two interior rows in the stores, and H, on which the final design is based, employed a large center bay.

be supported on spread footings. (*ENR* July 10, vol. p. 30) but in some areas these have to be combined to form a mat supporting several columns.

Column locations studied

Among the many intriguing problems encountered in the design of the Terrace Plaza Hotel was the determination of column spacing. Because of the different dimensions and functions of the lower and upper portions of the structure, no arrangement of the columns would provide favorable conditions in the stores and the hotel and at the same time be economical. Wind bracing also enters the problem, since the height of the building is considerable for 50- and 90-ft. widths.

Compromise and adjustments, therefore, had to be made. In the hotel, close column spacing could be obtained easily as the rooms are small and the columns are not objectionable when placed at wall or partition intersections. In the stores, however, a wide column spacing is desirable, because many columns interfere with the store fixture arrangement, detract from the appearance of the area, and decrease the amount of useful floor space. Thus, the various framing plans studied gave full consideration to the use of smaller column spacing in the hotel portion.

Scheme A (Fig. 5), the first one proposed, had a relatively small column spacing for the hotel, 12 ft. 6 in. one way and 15 ft., 14 ft. and 19 ft. the other. For the stores the column spacing was 25 ft. one way and 30 ft., 19 ft. and 10 ft. the other. It was felt that the small 10-ft. space along Thorpe Alley would not be objectionable, since elevators and stairs would occupy a considerable portion of this space, and alcoves in the stores could be put in the remainder to advantage. This plan was arranged to have as many columns as possible common to both hotel and store. Nevertheless, many of the hotel columns could not be carried all the way down. One entire east and west line and alternate north and south lines rested on girders.

A second scheme studied had longer beam spans, which eliminated the column transfers for the east-west lines. And a third, Scheme C (Fig. 5), used a large column spacing for the hotel, eliminating all column transfers.

A cost comparison of the three schemes indicated that the last was the most economical, mainly because of the great saving effected by the elimination of the cost of the column transfers. It thus became apparent that it was better in this building to avoid column transfers as much as possible, introducing them only where necessary to obtain proper space arrangement.

Further studies showed that 28-ft. bays in the east-west direction were more desirable than 25-ft. bays, since in the hotel section each bay could then contain two guest rooms at 14 ft., the minimum desirable width. While this increase in span requires slightly more steel and concrete, it is considered worthwhile for the advantages obtained.

Stores desire large bays

The next studies investigated column spacing in the stores. Scheme D (Fig. 5) employed only two rows of interior columns for the store, thus dividing the 90-ft. width into three large spans. Here, it was found economical to use double beams cantilevering past the columns and supporting a suspended span in the center bay. The double beams have an additional advantage in being less deep than single beams, thus reducing the height of the building. It was important to keep these beams shallower even than strict economy required to hold down the volume inclosed by the building to comply with Cincinnati zoning regulations, which limit the cubage to be constructed on any given property.

An alternative scheme employed three rows of interior columns, and because of the shorter spans, single beams were found more economical. A cost comparison showed that while Scheme D was slightly less economical, it was preferable because of the larger column spacing.

Further studies indicated the desirability of eliminating all wall columns in the first story along Sixth

TERRACE PLAZA FLOOR LOADS

Location	Dead Load psf.	Live Load psf.	Total Load psf.
Store (2nd to 7th)	80	75	155
1st and 8th floors	98	100	198
Basement	98	100	198
Sub-basement			
Truck area	100	20-ton truck	.....
Other areas	112	150	262
Hotel (9th to 18th floors)	56–69	40	96–109
Penthouse			
First level	80	100	180
Second level	80	150	230
Third level	75	150	225
Roof terrace (8th and 19th floors)	144	100	244
Roof (9th floor)	120	25	155
Roof (19th floor)	104–117	40	144–157

Note: The live load on hotel corridors and stairs was taken as 100 psf. Dead loads are for slab design only. For designing girders, weight of steel and haunches must be added.

Street and at the two ends of the building to allow clear, unobstructed glass areas for the store show windows. With these columns set back 6 or 10 ft., it was found more economical to offset them for their full height than to locate them in the walls from the second to the ninth floors and transfer them back with girders at the second floor. It was also found that the space on the second to eighth floors between the outer row of columns and the wall could be used to advantage for air-conditioning ducts and merchandising.

In addition, while making these other studies, the designers discovered that, in the hotel, long narrow openings running north and south in the center bay were needed for air-conditioning ducts and utility lines. This made it desirable to run the concrete joists in a north-south direction.

Finally, in Scheme H (Fig. 5) the column locations were changed to give a larger bay in the center and equal bays on each side, an arrangement which best met the needs of the fixture layout desired by the store tenant. In the case of the Penney store, a wide center aisle was also desirable to provide adequate space for the escalators with ample clearance on both sides. And the unusually high ceilings over the street floor in the Bond store made a large, impressive open space expedient.

In Scheme H, use of double beams was again found advantageous. In addition to benefits mentioned previously, double beams simplify the problem of offsetting the columns from the wall line and provide stiff connections to withstand wind bending moment (Fig. 6). They also make it possible to provide the long narrow opening at the west end of the store for the escalators without interfering with the wind bracing systems.

Scheme H with minor modifications was the basis of the final design. Adjacent to Thorpe Alley, additional columns were added where they were not objectionable, near stair walls or elevator banks. At the east end of the store, a large bay (44-ft. span) was introduced at the request of the tenant, and the hotel was shifted in position so as not to come over this area. The outer columns were offset 6 ft. 6 in. and 10 ft. from the building line.

At the column transfers it was found convenient to use T-flange girders, patented by the structural engineers. Consisting of web plates and heavy-weight, wide-flanged beams cut in half to form the flanges, with or without cover plates, this type of member permits more web-to-flange rivets than conventional plate-and-angle girders and sometimes eliminates flange rivets or else yields a shallower depth.

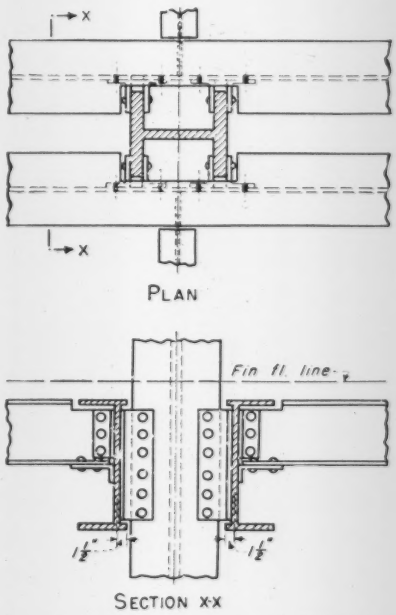


Fig. 6. Typical wind connection employed for double beams.

Throughout the development of the design, architects and engineers cooperated closely to obtain a satisfactory final solution because of the widespread effect of each decision.

Penthouse dining room

Another interesting structural problem was encountered in the framing of the almost entirely glass-inclosed circular restaurant on top of the hotel. Cutting off a corner of the building's utility penthouse, (Fig. 1) the dining room roof is a flat, reinforced concrete dome spanning 38 ft. 7 in. with a rise of 4 ft. at the center. The roof slab and the short, curved canopy that extends at roof level around the exterior of the room, are both 4 in. thick. The dome is supported on 12-in. WF 27-lb. curved spandrel beams, which in turn are carried on posts composed of two 4-in. channels.

These posts are supported at floor level on the tapered ends of 24-in. WF 76-lb. radial floor beams. Curved 8-in. 11.5-lb. channels join the outer ends of these beams. At the center of the room, the radial beams are connected to angles welded at regular intervals around the circumference of a 24-in. round ⅜-in. thick pipe and are made continuous by ⅜-in. thick plates passed over and below the pipe and riveted to the beam flanges. At a distance of 11 ft. 1½ in. from the center, the beams rest on columns.

Present estimates give the date of completion of the building as some time in the fall of 1947. Highlights of the construction operations will be given in a subsequent article.

The building was designed for Thomas Emery's Sons, by Skidmore, Owings & Merrill, architects. Moran, Proctor, Freeman and Meuser were foundation engineers; Weiskopf and Pickworth, structural engineers; Jaros, Baum & Bolles, mechanical engineers; and Guy B. Panero, electrical engineers. Frank Messer Sons are general contractors.

1,400-ft. Calyx Holes For Peruvian Hydro Job

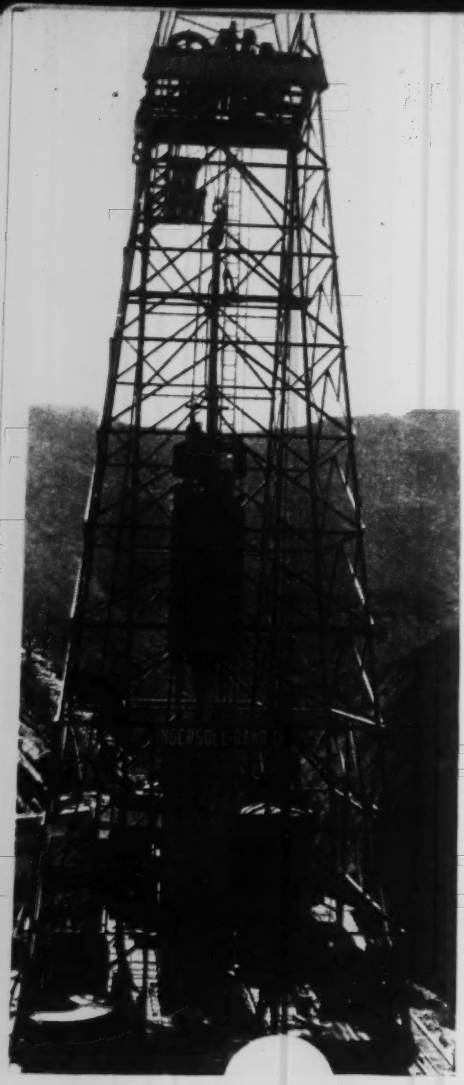


Fig. 1. A vertical shaft 6-ft. dia. and 1,400 ft. deep to a pressure tunnel is excavated by calyx drill turned by 100-hp. motor. The motor follows the cutting bit down and is held from turning by hydraulic clamps forced against the shaft walls.

A 6-FT. DIAMETER HOLE over 1,400-ft. deep is being cut in granite by a calyx drill and four additional holes will eventually be drilled to serve as penstock shafts for a power plant in Peru. The 125,000 kw. project, known as the Central Hidroelectrica del Canon del Pato, is 60 miles northeast of Chimbote. Design and construction is under the direction of Barton M. Jones, former head of the planning division of the Tennessee Valley Authority.

The work is part of a vast industrialization project in the Chimbote area undertaken by several Peruvian agencies, notably Corporacion Peruana del Santa. A description of the project appeared in *ENR*, Sept. 21, 1944, vol. p. 366.

A most unusual design for the hydroelectric project was required to meet local conditions on the Rio Santa. The Canon del Pato section of the river has an abrupt fall of some 1,400 ft. in a six-mile stretch below a catchment area of 110 sq. mi. A tunnel carries water some 30,000 ft. to where it drops vertically 1,200 ft. to an underground powerhouse.

It is to take care of the 1,200-ft. drop that the 6-ft. dia. holes are being drilled. But, to act as surge chambers and permit installation of control works the shafts are drilled from the mountain surface, some 200 ft. high. Fig. 6.

Progress of about 10-ft. per day is being made by the single drill now in use. The drill is a stemless type in which the motor follows the bit down for the full depth and is held against torque by anchoring against the shaft wall. Chilled shot is fed to the lower end of the calyx bit and cuts the rock as the bit is turned. As often as the bit cuts to its full depth, some 10 ft., it is withdrawn and a small explosive charge placed at one side of the core to break it near the bottom of the cut. The core is then lifted out of the hole and drilling is resumed.

Water that will pass through the tunnel and vertical penstocks will be taken from the Rio Santa at an overflow diversion dam now under construction at the upper end of the canyon. Here again unusual design and construction were required as the river, at high water stages, carries an unusually heavy load of sand and stone debris. As it was not practical to

Fig. 2. Thickened cutting edge of calyx bit is slotted to help control shot.

Fig. 3. Cores are broken loose by explosives and lifted out in this device, which has an internal clamping arrangement.

Fig. 4. Model of Canon del Pato Dam, intake and rock trap on the swift Rio Santa. Rock and sand dropped as the water slows in the trap can be washed back into the stream. The rock trap is just inside the tunnel.

Fig. 5. Canon del Pato Dam has a vertical face on the downstream side to avoid wear from overflowing rock. With this design rock washed over the dam is expected to form a protective cushion for other falling rock.

plan a storage reservoir, the dam to turn part of the flow of the river into the tunnel is of cemented granite masonry, only 72 ft. in height with a length along the overflow crest of about 82 ft.

It is expected that the area above the dam will be entirely filled with solids in a few weeks after it is put in service. Very abrasive rock and sand will then flow over the dam in large quantities, a condition that normally causes serious difficulties.

Rocks cushion fall

The structure is designed to withstand the effects of overflowing water and debris. The downstream face of the dam is vertical so that the stones carried over the crest will fall clear of the face and upon a cushion of stone in the canyon bottom. Large granite blocks laid in cement mortar are used at the overflow surface. Above this fixed masonry crest A-frame type adjustable steel gates will be installed to control the low-water flow.

The intake to the 30,000-ft. long 13½-ft. dia. pressure tunnel is higher than the fixed crest of the dam and is protected against large stones by heavy horizontal rack bars. It is not practical to attempt to remove the small rock, gravel and coarse sand by screening. Such debris will be largely removed by the trap shown in Fig. 4 that has a tunnel outlet underneath, through which the settled material can be flushed back into the stream. Another trap will take additional heavy material from the water just before it drops more than 1,200 ft. to the power house.

The project was estimated in 1941 to cost $4,000,000 including two 25,000 kw. units. An additional two units were estimated then to cost $1,875,000.

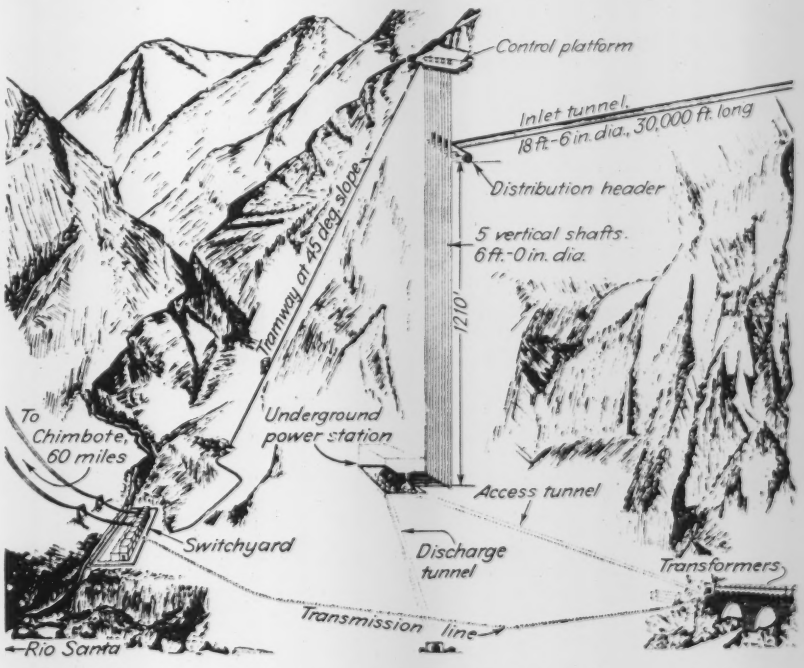


Fig. 6. Schematic plan of works and underground station at lower end of Canon del Pato. The shafts are drilled from the platform at the side of the mountain.

Repairing Unlined Portions of Tunnel Involves Difficult Transportation Job

***Contents in Brief**—Simple repairs to an unlined tunnel on a hydro-electric project in the high mountains involved a difficult transportation job. In removing an obstruction from the tunnel and lining some sections of it, 82 percent of the contract price was for transportation and equipment.*

UNUSUAL DIFFICULTIES in transporting equipment and materials through unlined tunnel were overcome recently in the repair of two sections of Ward Tunnel on Southern California Edison Company's Big Creek hydro-electric development. Access to the site of the repairs was a major item in the undertaking because equipment and material had to be moved through portions of unlined tunnel 11,000 and 3,000 ft. long, respectively. As the tunnel is a vital part of power generation facilities, it could be taken out of service for only a limited time during the fall of the year when the runoff was low.

Fig. 1. Accumulation of rock in Ward Tunnel on the Southern California Edison Company's Big Creek project. This rock fell from a fissure in the tunnel roof during a period of 20 years.

The work in one part of the project included the removal of a partial obstruction to the tunnel consisting of a pile of large granite blocks which had fallen from a fissure in the roof during the 20-yr. period since the tunnel was built, and the placing of a 2-ft. thickness of concrete to seal the fissure and prevent any more rock from coming down. At the other location a 20-ft. section of reinforced gunite lining was placed inside the existing concrete lining which had become fractured from the shearing force of loosened sections of rock. After the gunite lining was in place grout was forced in behind the fractured lining under high pressure.

Maintenance after 20-yr. service

The Ward Tunnel, located in the Sierra Nevada some 50 miles northeast of Fresno, Calif., completed in 1925, takes water from Florence Lake to Huntington Lake to provide a year-round supply of water for power generation. The tunnel is about 13 miles long, 16x16 ft. in cross-section and has a fall of 3 to 3.5 ft. per thousand (elevation at inlet end—Florence Lake—is 7,220 ft. and at outlet end—Huntington Lake—is 7,000 ft.).

As the tunnel was driven through granite, less than 10 percent of the length was lined and, when construction was completed, the invert in the unlined section was relatively free from irregularities. However, the effect of water flowing through the tunnel for over a period of 20 years (amounting at peak periods to 2,200 cfs.) was to change the floor to the extent that when the tunnel was unwatered there were occasional pools as much as 3 ft. deep. It was over this rough, uneven floor that materials and equipment for the repairs were transported. Granite blocks in the invert which had been angular when the tunnel was built were found

to be worn into rounded cobbles by two decades of flowing water.

The partial obstruction (Fig. 1) was known to have been there for a number of years, but for a long time no effect was observed on the quantity of flow through the tunnel. By 1940 the obstruction had become large enough to force the water at this point against the tunnel roof, thus causing a greater frictional effect on the flow. In spite of this, even up to the time of repair, the flow was not seriously impaired.

Power company engineers considered it advisable to clear the obstruction (a) before it might cause some marked effect on power production and (b) to concrete the fissure as a means of avoiding risk of a more serious fall of rock. While the tunnel was out of service for repair, it was also though advisable to inspect the full length and to make any other repairs that might be necessary. The power company therefore let a contract for removal of the obstruction, lining the fractured section, and making other repairs.

Access difficult

Because of the roughness of the invert, it took five days for the first piece of equipment, a diesel tractor carrying a bulldozer blade, to travel the 11,000 ft. from the portal to the obstruction. Other equipment brought in over this extremely rough route included an electric compressor, a concrete pumping machine and a 50-kw. generator. The generator was moved in on a diesel truck, an operation which proved difficult as the truck had to be towed through pools where water depth was as much as 3 ft. but which the tractor was able to traverse under its own power.

The contractor's original plan was to provide power for the compressor and concrete placing machine by bringing a 2,300-volt electric cable into the tunnel. This cable was laid on the rough invert without protection. Here it was subject to the wear and abrasion of passing wheels and crawler treads. Resultant damage made the cable unusable and caused the job to be delayed until a 50-kw. generator could be brought in.

Because the tunnel is open at the outlet and at several points along its course, the natural draft of the tunnel was sufficient to remove diesel and powder fumes, and no artificial ventilation was necessary while the work was under way. Blasting was done between shifts.

The specifications called for the fallen rock (about 60 cu.yd.) to be broken up into blocks weighing 100 lb. or less and moved to nearby low places in the invert. Individual rocks were first blasted by light powder charges. The pieces were then moved by the bulldozer to the low places. Haul ranged from 200 to 300 ft. The size of the broken rock can be seen in Fig. 2.

Lining tunnel roof

Concrete 2 ft. thick was placed in the roof for the 150-ft. length from which the rock had fallen. The space behind this new concrete was to be filled with rock-back packing. In lining the roof, the contractor first placed the required rock-back packing supported by timber bracing. A form was then built at roof level and the concrete placed by pumping it into the space above this form. This method left in place the rock-back packing as well as the timber supports. The new concrete (about 65 cu.yd.) was placed by a concrete pumping machine and, after the concrete had reached the proper strength, the bottom forms were stripped, leaving the slab as it appears in Fig. 2. The steel hooks in the rock of the tunnel roof in Fig. 2 were used to support the forms.

Concrete was mixed at the outlet portal, using aggregate brought overland from Florence Lake, some 13 tunnel miles away. The mixed concrete was trucked through the 2 miles

Fig. 2. Same portion of tunnel after completing repairs. Fallen rock was broken up and removed, after which the fissure was sealed off with 2 ft. of concrete.

of tunnel by diesel-power end-dumping earth-movers having a capacity of 3 to 4 cu.yd. each, which did not have to be turned around in the narrow tunnel as they have three speeds in each direction. The irregularities in the invert having been smoothed out somewhat by a bulldozer, the time in transit for the concrete was only about 20 min.

The second major portion of the repair work was the placing of a 20-ft. section of reinforced gunite lining inside the existing concrete lining which had become fractured by the weight of the rock it supported. This work was located some 3,000 ft. downstream from an 85-ft. vertical shaft which provided access to the work. The shaft is roughly half way between Florence Lake and Huntington Lake. After placing the gunite lining to a minimum thickness of 8 in., the tunnel at this point had a circular section with a radius of 6 ft. 2 in. Water velocity in the repaired section at peak flow (2,200 cfs.) is about 20 fps. However, after a trowel finish, the surface of the concrete lining is so smooth that velocities of this magnitude are not expected to be harmful.

In order to consolidate the broken granite behind this part of the tunnel lining and prevent further damage to the lining, grout was forced in at high pressure. This grout was placed in two stages through holes 60 deg. apart. The first step required grout pipes at least 2 in. in diameter and extending 4 ft. beyond the concrete tunnel lining. These 4-ft. holes were grouted to a pressure of 50 psi. The second stage provided that the grout holes be drilled in 8 ft. from the inner face of the concrete and a 1½-in. minimum diameter pipe be used. Final grouting was done to refusal at a pressure of 125 psi.

While about 10 percent of the tunnel was lined, the invert in most lined portions was not covered with concrete. In some of these portions of the tunnel the action of the water, during the 20-yr. period since construction, had undercut the wall lining. To prevent further undercutting, the contract required the placing of 1,963 lin. ft. of concrete floor in the 18 lined sections of the tunnel between the two repair jobs and the points of access.

The transportation difficulties involved in this job are indicated by the fact that of the total contract price for the work, 82 percent was for providing equipment and access facilities. The job was performed by the Grafe-Callahan Construction Co. and the Gunther & Shirly Co., both of Los Angeles. Charles Clapp was field superintendent for the contractor. W. L. Chadwick is manager of engineering for Southern California Edison Co., and R. W. Spencer is chief civil engineer. Field engineering on the tunnel repair project was handled by H. A. Barber.

Joints in Concrete Pavement Sealed by Truck Mounted Rig

A truck mounted rig for filling longitudinal joints in concrete pavement has been developed for use on the California highway system. Two assemblies, so arranged that the asphalt which is kept at a temperature of 350 to 400 deg. F. can be continually circulated to prevent clogging of lines, are attached on each side of a truck carrying a 940-gal. asphalt heating tank. Although use of this equipment is still in its preliminary stages, a cost saving of some $18 per mile for a two-lane pavement is expected according to H. L. Cooper, assistant maintenance engineer, who helped develop the equipment.

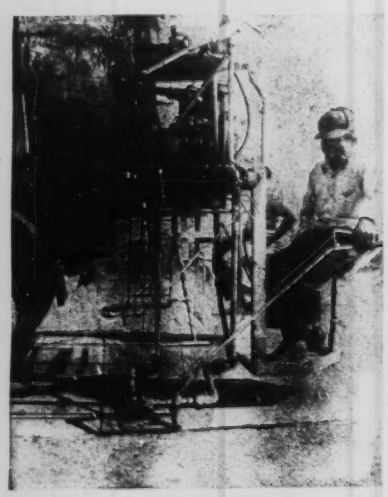


Fig. 1. Two circulating pipe assemblies are attached to a 940-gal. tank truck for simultaneous sealing of two longitudinal joints in concrete pavement. Swivel pipe connections permit side movement so operator can follow joint.

Swivel joints constructed to operate under high temperature were used in the assemblies to provide for sufficient side movement of the nozzles to allow the operator to follow the joints easily. After a day's work is completed, the assembly is disconnected and flushed out with distillate so that it is clean and ready for a new start.

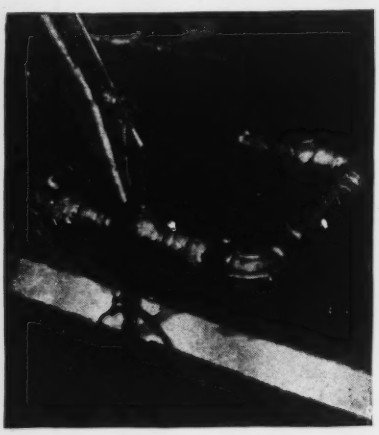


Fig. 2. Extra jets are provided on needle valve to permit better filling of joint.

The truck operates at a speed of from 1.5 to 1.8 mph. allowing operators in one district to pour an average of 13½ mi. of joints per day with 19½ mi. being maximum for a day's run.

For two-lane highway work, two joints are poured while the truck is moving in one direction and the third joint poured on the return trip. The finished joint presents a neater and truer line than can be attained by hand methods which are still used for the transverse joints.

The original needle valve installation permitted the use of one stream or jet of filler. A later development had two jets, one fore and one aft. The forward jet would force air out of the joint permitting more even joint filling. Now in use are valves with three jets, which appear to give even greater uniformity.

Comment and Discussion

Readers' opinions on matters that concern engineers and contractors

Wood-Truss Failure

Sir: It is only through analysis and study of failures, either in actual service conditions or in controlled tests, that a more complete understanding of performance of structures and an improved method of design can be developed. Thus, it is important that the analysis of such failures be based on design recommendations and that all comparisons of failure loads and design loads be justly made. In the article, "Lessons Taught by Wood-Truss Failures," by Norman B. Green, *ENR* May 1, vol. p. 753, several erroneous and misleading statements were unintentionally made, and comparisons drawn between failure and design loads, that, in the interest of proper engineering analysis, should be amended.

The author states, "It is believed that this failure may be classified primarily as a tension failure." If it is accepted that failure occurred in tension in the wood adjacent to and between connectors, then the value of the comparisons between failure load and connector design load shown in the table are somewhat questionable. The presence of the connectors in the joint undoubtedly contributed to the failure but it would seem more correct to place more emphasis on the stress on the net section.

It is stated that unit stress on the 4.5 sq. in. of net section of the diagonal in joint L_1 was 2,100 psi. at failure. This 4.5 sq. in. is the actual cross-sectional area of the break. In checking this joint for net section during design, a larger area—7.67 sq. in.—would be used, and an allowable unit stress equal to the compressive stress of clear wood assigned. This would be 1,750 psi. according to 1944 specifications of the National Lumber Manufacturers Association. Using 7.67 sq. in. instead of 4.5 sq. in., the unit stress at failure was only 1,240 psi. Or it may be said that the diagonal member failed at only 71 percent of design load. This seems to be the really important factor.

To the writer's knowledge no test data are available for conditions approximating this joint. It seems, however, that the method of computing net section requirements could bear further investigation. It is quite likely that a condition similar to stress raisers or concentration of stress in metal structures may exist. With the sudden change in cross-section resulting from the grooves for the split rings, considerable concentration of stress may occur. Where 4-in. split rings are used in 2-in. nominal dimension lumber, the net section is only $\frac{5}{8}$ in. thick, whereas the member is $1\frac{5}{8}$ in. thick.

The author also states, "The Forest Products Laboratory recommends a factor of safety of 4 for this (split-ring) type of connector. . . ." This is incorrect. The FPL applies a factor of 4 to ultimate test loads for parallel to grain loading, but this is not a safety factor. This adjustment factor of 4 includes a $\frac{9}{16}$ factor to convert from short-time test loads to permanent loads and a factor of $\frac{3}{4}$ to cover variability. The split-ring design values given in the "Teco Design Manual for Teco Timber Connector Construction," 1943 edition, average 20 percent more than the values obtained by applying the adjustment factor of 4 to test results. Thus, for a low grade piece of lumber, the actual safety factor would be expected to be about 1.41.

As previously mentioned, it is questionable as to the value of the comparisons between design and failure loads as shown in the table in the article. The values shown in the table need correction to be in accordance with design recommendations. It is the understanding of the writer that the lumber used for these trusses was green; that is, the lumber was shipped directly from mill to site without proper time for seasoning. Thus, the standard design load for one split ring, line 5 in the table, should be only 80 percent of the values shown. This is in accordance with Timber Engineering Co. recommendations. Thus, the allowable loads for edge distance, end distance, and spacing should be only 80 percent of the values shown.

An error in interpretation of the multiple-connector limitation has been made in the table in the computation of the allowable load for the group of connectors. The limitation provides that 230 percent of one 4-in. split-ring connector value is the maximum value for a group of connectors in the same face of $1\frac{5}{8}$-in. lumber not offset perpendicular to grain a distance equal to the connector diameter, and acting 45 deg. to 90 deg. with the grain.

The limitation applies to the connectors in only one face of the diagonal. Thus, for joint L_1 the limitation is 230 percent divided by 3, or 76.6 percent of the basic value of one split ring, and for joint L_2 230 percent divided by 2, or 115 percent, of the basic value of one split ring. In joint L_1 the end distance limitation was 65 percent of the basic value, and in joint L_2 68 percent. These end-distance percentages are smaller than those for edge distance, spacing, or multiple connector, and thus, the design values for end distance control. If the corrected values for end distance (80 percent of those shown in the article) are divided into the values for actual load, corrected values for factor of safety will be obtained: Joint L_1, diag. to vert. 1.34, diag. to chord 1.26; Joint L_2, diag. to vert. 1.66, diag. to chord 1.67.

The comparison in the table between failure loads and seismic or wind design loads does not represent a valid comparison. The factors thus derived have no value whatsoever. There is no justification for comparing long-time failure load with short-time design load. To make such a comparison is to assume that the joint would fail under a seismic or wind load equal to the long-time load that caused failure, and it is an accepted fact that wood will withstand a much greater load for short duration than for long. This latter part of the table should be omitted.

In summary, the conclusions drawn are admittedly somewhat debatable. The recommendation that 4-in. split rings should not be installed in opposite faces of $1\frac{5}{8}$-in. thick material is not necessarily the best solution. A limited number of tests have shown

that equal or better loads are realized in $1\frac{5}{8}$ material than in $2\frac{5}{8}$. Furthermore, thousands of structures have used such details without trouble. It would seem that a better solution would be an investigation of allowable stresses on the net section, as pointed out in the article. This would correct what the writer feels is the probable trouble without limiting the application of the split-ring connectors.

The comments in the article regarding application of the multiple-connector limitation are not well founded. As was pointed out previously, the end-distance reduction controlled from a design standpoint in this failure. Although some further study of multiple connectors in a joint may be desirable, a report soon to be published by the Timber Engineering Co. indicates that the limitation as presently defined is over-conservative. In fact, test data for $2\frac{5}{8}$-in. material also covered by the limitation indicate no appreciable reduction for four 4-in. split rings in one face.

R. H. Gloss
Structural Engineer
Timber Engineering Co.
Washington 6, D. C.

Sir: Mr. Gloss is of the opinion that comparisons between failure load and connector design load, as shown in the table, are questionable, since the failures were not normal split-ring connector failures but tension failures. The two factors that determine the net section and the strength in tension are the connector spacing and the thickness of the members connected.

If present design requirements for spacing and thickness are incorrect, they should either be changed or the permissible connector loads with the present requirements should be reduced. In any case, the need for such changes can only be demonstrated by comparing design loads with failure loads. Furthermore, in the case of joint L_2, shear failure at the bottom of the ring grooves, as well as tension failure, was involved.

With regard to factor of safety, the original publication of the FPL referred to in the article simply states that ultimate test loads should be divided by four to obtain "safe loads." In a more recent publication, "Timber Connector Joints—Their Strength and Design," published by the U. S. Dept. of Agriculture, the same factor of four is employed. However, it is there stated that it includes a $\frac{9}{16}$ factor to convert to long-time loading and a factor of $\frac{3}{4}$ to cover variability.

Therefore, the recommended design load would be the actual long-time load per connector developed in the truss at failure, divided by $4 \times \frac{9}{16}$, or 2.25. I am indebted to Mr. Gloss for calling attention to the necessity of increasing the actual ultimate loads developed in the trusses at failure so as to make them comparable to short-time test loads on which design recommendations are generally based.

Mr. Gloss has also introduced the question of seasoning of the lumber in the trusses, and an investigation of this matter by the writer has developed the following information: The trusses were fabricated by a concern that specializes in that type of work. The lumber was obtained out of stock from a large local yard, where it was the practice to segregate the better grade of lumber suitable for trusses. Generally, this lumber contained from 15 to 18 percent of moisture.

In the present case, since the job was relatively small, no check of the moisture content was made. It seems likely, therefore, that the lumber was quite well seasoned at the time of fabrication and probably the analysis should be made on that basis, rather than with a reduction factor of 20 percent as has been done by Mr. Gloss.

Employment of his interpretation relative to the multiple-connector limitation and assuming seasoned lumber, the following factors of safety are obtained: Joint L_1, diag. to vert. 1.07, diag. to chord 1.30; Joint L_2, diag. to vert. 1.33, diag. to chord 1.34. With the exception of the first factor, which is the same, all these factors are less than those given in the article.

Mr. Gloss believes that the portion of the table relating to seismic and wind forces has no value whatsoever. But his remarks on this matter add nothing of practical value, since wind, and particularly seismic forces, are not simply short time. They are rapidly applied, reversible and repetitive. It is possible that under these conditions a connector joint will fail under loads not equal to, but less than for long-time loading. In the absence of adequate information on the effects of this type of loading, perhaps a factor of safety based on long-time loading affords the best available guide for design.

Mr. Gloss has presented an interesting discussion, but he has not contributed any facts that lead the writer to change any of the final conclusions stated in the article. It may be true that thousands of structures have used details having 4-in. rings on opposite faces of $1\frac{5}{8}$-in. thick material without trouble. However, this is not conclusive proof that such design is sound.

Failure of connector joints may not be apparent until several years after the structure is put into service, as in the present instance, and the change in the rule which permits thinner members is relatively recent. Also, most structures do not receive the full live load employed in the design. In addition, many failures of wood trusses probably occur that are not reported in engineering literature. In fact, it is the writer's experience that those that are reported are the exception rather than the rule.

I am aware of another case involving the failure of wood-connector trusses, which I hope to be able to analyze and report on in the future. In this case also, rings were placed concentrically in the opposite faces of $1\frac{5}{8}$-in. thick members.

Norman B. Green
Structural Engineer
Los Angeles 13, Calif.

North vs. South Dakota

Sir: I enjoyed reading the article on sewage treatment plants for trains (June 19, vol. p. 977). The information presented is substantially correct, with the very minor exception that you list me as former state sanitary engineer of South Dakota, whereas it should have been North Dakota. I realize that these are sister states, and I have a very high regard for our neighbor to the south. Being so close to North Dakota, it is probably the second best state in the union. However, my loyalty to my native state still prompts me to call attention to my correct origination.

Lloyd K. Clark
Manager, Sanitation Research Project
Association of American Railroads
Baltimore, Md.

Book Notes and Reviews

The month's addition to the engineer's reading and reference list

Educating the Public

CHICAGO'S REPORT TO THE PEOPLE—Prepared by the research division of the Law Department, 372 pp. Obtainable from the City Council, City Hall, Chicago, Ill.

Taking a tip from a few other cities that have learned the value of educating their citizens as to what the city does with their money, Mayor Kelly of Chicago has submitted to the City Council "Chicago's Report to the People" in a form that is so attractive as to insure wide reading. While the book relates chiefly to the city's operations during the year 1946, it also covers the accomplishments of Mayor Kelly's administration, which closed this year. Good photographs, drawings and charts have been used freely to illustrate the report.

Air Conditioning

AIR CONDITIONING AND ELEMENTS OF REFRIGERATION—By Samuel P. Brown. 644 pp. McGraw-Hill Book Co., New York 18 and London. $4.75.

HEAT PUMPS—By Philip Sporn, E. R. Ambrose and Theodore Baumeister. 188 pp. John Wiley & Sons, New York, and Chapman & Hall, London. $3.75.

For the student interested in design, installation or operation of heating, cooling and ventilating equipment for buildings, the first of these books could serve as a text and handbook. Emphasis is placed on the understanding of fundamentals, but typical manufacturers' rating data for equipment and data from the American Society of Heating and Ventilating Engineers' *Guide* are reproduced to make this book a complete manual for the design of all but the most complex multistory systems.

In present commercial practice, the name heat pump is given to a year-round air-conditioning system employing refrigeration equipment in a manner that enables a surface to deliver usable heat to a space in winter months and to extract heat from the same area during the summer. The second book deals with problems encountered in the attempt to adapt the heat pump to building heating and cooling and to industrial applications. The subject is treated by successive consideration of thermodynamic principles; equipment design, specification and selection; and maintenance, operating, economic and installation problems.

War Construction

AMERICAN MIRACLE—The Story of War Construction Around the World—By Van Rensselaer Sill 300 pp. The Odyssey Press, New York $4.

Millions of people in work clothes and in uniform performed America's construction miracle of the war years, and it is for these people that "American Miracle" is written. The book is non-technical; it gives a lot of facts and anecdotes about production and about war that make it interesting and informative. More than 60 full page photographs and scores of sketches add much to the book.

A brief resume of the work of each of the several government agencies responsible for the $49 billion construction job done for the war provides facts and figures on accomplishment.

Engineering Mechanics

APPLIED ENGINEERING MECHANICS — By Alfred Jensen. 316 pp. McGraw-Hill Book Co., New York 18 and London. $3.00.

Coupled with a knowledge of the properties of materials, engineering mechanics provides the basis upon which structures and machines are designed. Yet students often encounter difficulty in grasping the essential principles of this fundamental subject.

This book uses a simplified approach requiring only an understanding of high school mathematics and emphasizes the physical concepts involved. Consistently following the principle of developing a subject from the simple to the complex, it makes ample use of practical problems—that stimulate the reader because they often cover his personal experience—to demonstrate the application of theories described.

Basically, the book is divided into two sections: Statics and Dynamics. It contains 20 chapters, each composed of several related articles. Each subdivision develops a theory, a new concept or a different aspect and is followed by one or more completely solved examples illustrating application. Furthermore, analytical and graphical solutions are placed side by side to show how problems may be checked.

Not only students but also engineers studying for professional license examinations will find this volume surprisingly helpful.

A Broad Look at Planning

AMERICAN PLANNING—PAST, PRESENT AND FUTURE—By Cleveland Rodgers. 290 pp. Harper & Brothers, New York 16. $3.

City or regional planners who look to this book for specific information on planning will be disappointed. Its purpose is to set forth what the broad objectives should be in national planning. The author, who for years was a newspaper editor and now is a member of the Planning Commission of New York, lets a young aviator write the book, a youth whose first and only acquaintance with much of this country and the world was from the vantage point of an airplane, which puts the works of man into proper perspective. Coming back from the war, the young man reviews the history of this nation to learn what types of national planning were used by our forefathers, and against this background looks at the broad national issue of today.

Sanitary Text Revised

WATER SUPPLY AND SEWERAGE—Second Edition.—By Ernest W. Steel. 666 pp., McGraw-Hill Book Co., New York 18, and London. $6.

Like its predecessor which appeared in 1938, this volume covers two important and expanding fields, but it does so effectively. It will appeal perhaps more to the student than to the practicing engineer because the material is presented in a compact, and simplified form, characteristics that should encourage its use in connection with introductory college courses.

Treatment processes and design

methods are briefly described and evaluated with concise statements of advantages and disadvantages. Typical examples are included to illustrate the theory described, and ample references are provided to encourage collateral study and to support statements made. For the most part the illustrations are good and placed so that understanding of the material is facilitated.

In the first part—which deals with water supply and treatment—the section on chlorine has been revised and expanded to include a discussion of the breakpoint process. Also, additions have been made to bring the material on water softening and correction up-to-date. In the appendix, the 1942 U. S. Public Health Service standards for drinking water may be found.

The second part, consisting of 328 pages, is devoted to the collection and treatment of sewage. New data have been added to cover the descriptions of sewage pumping and pump maintenance more completely. Furthermore, additional space has been given to high-rate trickling filters, a recognition of the important position that this method of treatment now occupies among sanitary engineers.

Engineering Law

CONTRACTS IN ENGINEERING — By James Irwin Tucker. Fourth edition 340 pp. McGraw-Hill Book Co. New York 18 and London. $5.

A standard text brought up to date. This book features evidence since it chiefly aims to show that the carefully prepared, written construction or other contract is the best evidence of intention of the parties.

The revised edition covers fully the currently important subject of renegotiation and other war generated legal problems and principles.

Miscellaneous Notes on Booklets and Reprints

WHAT IT TAKES to make a better city is the subject of Pamphlet No. 13 of the California State Reconstruction and Reemployment Commission, (631 J Street, Sacramento 14) which bears the title "The People Design the City." In 26 pages illustrated with humorous sketches the pamphlet tells how public spirited citizens set out to rectify the municipal shortcomings of Santa Rosa and what they found to be necessary.

CRAWLER TRACK LUBRICATION AND MAINTENANCE is the subject of the entire June, 1947, issue of *Lubrication*, which is published by the Texas Co., 135 East 42d St., New York 17.

A SCHEDULE of Recommended Salaries and Fees for Professional Engineers has just been issued by the Iowa Engineering Society. The grades of engineering employees are similar to those in the ASCE schedule. Minimum rates for these grades are based on the cost of living in Iowa as of July, 1946, and provision is made for adjustments in the future in line with changes in the "Index of Cost of Living in Large Cities" prepared currently by the U. S. Bureau of Labor Statistics. Copies can be obtained from the society office at 418 Hubbell Bldg., Des Moines 9, Iowa.

HIGHWAY COST STUDIES made in recent years are reviewed in a multigraphed pamphlet entitled "Review of Highway Cost Studies: 1932-1946," prepared by Chester K. Smith, research engineer, Western Association of Railway Executives, Chicago, Ill. The pamphlet lists all the principal studies made during that period, both state and national, giving their scope and general conclusions as to highway costs and the allocation of such costs to the various types of motor vehicles. Principal attention is devoted to a discussion of the wide variety of conclusions reached in these reports. The author lists the items on which there is reasonable agreement and those on which there still is a wide divergence of views. Copies can be obtained from H. M. Sims at the association's headquarters, 105 W. Adams St., Chicago 3, Ill.

New Engineering Books

NATURAL PHILOSOPHY OF THE SCIENCE OF PHYSICS CHEMISTRY AND ENGINEERING—By C. A. P. Türner. 320 pp. Obtainable from the author, 964 N. High St., Columbus, Ohio. $6.

LEHRBUCH DER TECHNISCHEN MECHANIK STARRER SYSTEM—By K. Wolf. 370 pp. Springer-Verlag, Vienna, Austria. Obtainable through Stechert-Hafner, Inc., 31 East 10th St., New York 3. $7.50.

AIRPORTS OF TOMORROW—New Jersey-New York-Connecticut area—47 pp. Regional Plan Association, Inc., 205 East 42nd St., New York 17.

HEAT PUMPS—By Philip Sporn, E. R. Ambrose and T. Baumeister. 188 pp. John Wiley & Sons, New York 16. Chapman & Hall, London. $3.75.

PHYSICS FOR STUDENTS OF SCIENCE AND ENGINEERING—By W. H. Michener. 646 pp. John Wiley & Sons, New York 16. Chapman & Hall, London. $4.25.

ANATOMY OF DEPRECIATION—By L. R. Nash. 214 pp. Public Utilities Reports, Inc., Washington, D. C. $5.

THE ROME CABLE MANUAL OF TECHNICAL INFORMATION — 1st Edition — 263 pp. Rome Cable Corp., Rome, New York. $2.50.

MEN AND VOLTS AT WAR—The Story of General Electric in World War II—By John A. Miller. 272 pp. Whittlesey House, McGraw-Hill Book Co., New York 18, and London. $3.75.

AIR CONDITIONING AND ELEMENTS OF REFRIGERATION—By Samuel P. Brown. 644 pp. McGraw-Hill Book Co., New York 18, and London. $4.75.

SURVEYING INSTRUMENTS AND METHODS—By Philip Kissam. 384 pp. McGraw-Hill Book Co., New York 18, and London. $3.50.

WATER SUPPLY AND SEWERAGE—By E. W. Steel. 666 pp. McGraw-Hill Book Co., New York 18, and London. $6.

Reports and Pamphlets

PROCEEDINGS OF THE SEVENTH TEXAS CONFERENCE ON SOLID MECHANICS AND FOUNDATION ENGINEERING — University of Texas, Austin 12, Texas. $2.

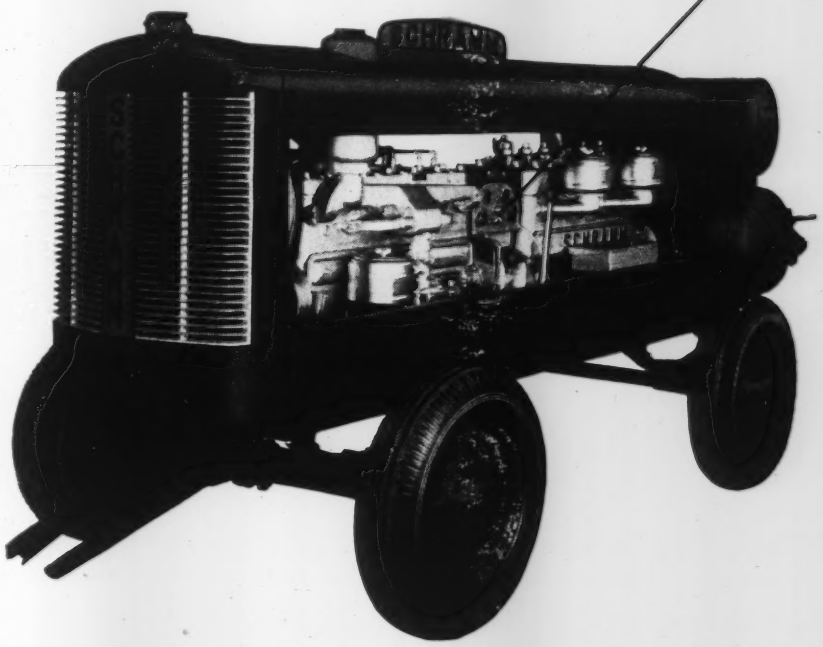
DIRECTORY OF MEMBER INSTITUTIONS AND REVIEW OF CURRENT RESEARCH—Engineering College Research Council, State University of Iowa, Iowa City, Iowa. $1.

JOURNAL OF INDIAN ROADS CONGRESS—No. 3—ELEVENTH SESSION—Indian Roads Congress, New Delhi, India. 5s.

WAGE RATES AND HOURS OF LABOUR IN CANADA—No. 28. Department of Labour, Ottawa, Canada.

HIGHWAY PLAN FOR BATON ROUGE—Department of Highways, Baton Rouge 4, Louisiana.

JUST PUSH THE BUTTON



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MATERIALS AND LABOR PRICES

Market quotations on construction materials and wage rates reported monthly by ENR correspondents

September Materials and Labor Prices will appear in the September 18, 1947 issue.

Mexico City, Mexico prices will be published in this section of Engineering News-Record, beginning with this issue.

CEMENT, AGGREGATE, READY-MIXED CONCRETE — F. O. B. CITY

	PORTLAND CEMENT — Per bbl. C/L lots incl. $1.00 per bbl. for bags, cash. dis. not deducted			SAND AND GRAVEL — Per ton, carload lots			CRUSHED STONE — Per ton, carload lots		CRUSHED SLAG — Per ton, carload lots, f.o.b. plant		CONCRETE BLOCK — 8x8x16-in.; truckload del.; per block		READY MIXED CONCRETE — 1:2:4, over Sand grav. Lt.wgt.Agg. 50 c.y.,del.
	Cloth	Paper	Bulk	Gravel, 1½ in.	Gravel, ¾ in.	Sand	1½ in.	¾ in.	1½ in.	¾ in.	Sand grav.	Lt.wgt.Agg.	
Atlanta	$3.62	$2.77	$2.52	....	....	....	$2.10	$2.10	$1.65	$1.85	$0.1725	....	$10.05
Baltimore	3.46	2.61	2.36	$2.10‡	$2.10‡	$1.60‡	2.20‡	2.20‡	2.20‡	2.20‡	.145	$0.145*w*	8.3.5
Birmingham	3.42	2.57	2.32	2.06	2.06	1.63	2.50	2.50	1.00	1.20	.1425	.1425	6.95
Boston	3.88	3.08	2.78	1.50‡	1.50‡	1.40‡	1.25‡	1.35‡	....	....	.186	.195*w*	8.50*m*
Chicago	3.40*mm*	2.60*mm*	2.30*mm*	2.50‡*d*	2.50‡*d*	2.75‡*d*	2.50‡*d*	2.50‡*d*	2.00‡	2.00‡	.195	.195*x*	....
Cincinnati*	3.34*s*	2.49*s*	2.24*s*	1.70‡*bb*	1.70‡*bb*	1.60‡*bb*	2.75‡*bb*	2.75‡*bb*	....	....	.17	.195	8.40*hh*
Cleveland	3.50	2.65	2.40	1.90*llig*	1.65*llg*	1.15*ll*	3.20‡	3.20‡	2.45	2.45	....	.20	10.15
Dallas	3.32	2.47	2.22	1.80	1.80	1.60	1.89	1.99	....	....	.0775*p*	....	8.68
Denver	3.93	3.08	2.83	1.85	2.00	1.15	....	....	....	....	....	.2175*w*	9.00
Detroit	3.40	2.55	2.30	2.75	2.75	2.50	2.50	2.50	2.50‡	2.50‡	.16	.17*w*	8.30*kk*
Kansas City	....	....	....	2.00	....	1 40	2.00	2.00	....	....	.16	.16*wy*	8.50*n*
Los Angeles	3.30*eeb*	2.80*b*	2.40*b*	1.55	1.55	1.40	1.40*f*	1.40*f*	1.40*f*	1.40*f*	.125*nn*	.14*nn*	8.75*m*
Minneapolis	3.70	2.85	2.60	2.00*htj*	2.00*htj*	1.10*htj*	2.10*htj*	2.10*htj*	....	....	.183*cco*	....	9.05*jkk*
Montreal	....	2.05*r*	1.90*r*	1.78*bbs*	1.78*bbs*	1.10*s*	.95*cs*	1.05*cs*	....	....	.1391	.1515*w*	7.75*ls*
New Orleans	3.23	2.43	2.18	1.82	1.82	1.62	....	....	.90	1.15	...	....	9.92
New York	4.60‡	3.60‡	....	1.85*de*	1.85*de*	1.30*de*	1.90*de*	1.90*ds*	....	....	18/.20*ii*	.16/.18*wccii*	9.90*k*
Philadelphia	3.32‡	2.47‡	2.22‡	2.20‡	2.30‡	2.05‡	1.90‡	1.95‡	1.50	1.50	.20	.20*w*	8.80
Pittsburgh	3.36	2.51	2.26	1.90‡	1.90‡	2.20‡	2.35‡	2.35‡	1.90	1.90	.22*z*	.22*z*	....
St. Louis	3.52*o*	2.67*o*	2.42*o*	2.25‡*oh*	2.25‡*oh*	2.00/2.25‡*oh*	1.35*c*	1.35*c*	....	....	.175	.22*yo*	9.80
San Francisco	3.54*jj*	2.64	2.24	1.56	1.56	1.66	1.66	....	....	....	....	.25*y*	9.05*u*
Seattle	3.35*gg*	3.10	2.80	2.50‡*od*	2.50‡*od*	2.50‡*od*	3.00‡*od*	3.00‡*od*	....	....	.18*o*	....	8.75*o*

‡ Delivered. *b* 20c. per bbl. off for payment by 10th of following month. *c* F.o.b. quarry. *d* Per cu. yd. *e* Barge lots alongside docks. *f* Crushed granite. *g* Pea gravel. *h* Truck Lots. *i* ½ in. *j* 5% discount for cash. *k* Discount of 2 percent for cash in 10 days. *l* 2000 lb. concrete. *m* 50c. off for cash. *n* 25 c.y. or more. *o* 2% off for cash. *p* 5½ x 8 x12 in. *r* 10% per bbl. off cash 20 days. *s* 8% sales tax included. *u* 10 to 100 c.y. brackets. *v* Add 15¢ for delivered price. *w* Cinder. *x* Waylite. *y* Havdite. *z* Celocrete. *bb* 5 tons or more. *cc* Also 8 x 8 x 18 in. *ee* 20c. refund for each returnable bag. *gg* 10c. refund for each returnable bag. *hh* Truck loads up to 500 c.y. Over 500 c.y. lots, 50¢ less per yd. *ii* Yard price. *kk* 2500 lb. compression strength. *jj* 30¢ refund for each returnable bag. *ll* Price at plant. Called for. *mm* June price was delivered price. July and Aug. prices to dealers. Add 1¢ to 15¢ for dealer markup. *nn* 4 x 8 x 12 in.

* Jan.-June, 1947 prices now available.

CASH DISCOUNTS CEMENT to Contractors: truck delivery, 2% for cash on 10th of month; on carload deliveries, no trucking, same as dealer cash discount, 10c. per bbl. for payment within 15 days of date of invoice. Subject discount 10c. per bbl. 20 days in Montreal.

CURRENT MAXIMUM PRICE BASES AT CEMENT MILL

Charge for bags not included. For cloth bags, add $1.00 per bbl.; 25c. refund allowed for each returnable bag; for paper bags add 20c. per bbl., not refundable.

	Bagged	Bulk		Bagged	Bulk		Bagged	Bulk
Buffington, Ind.	$2.00	$1.95	Ironton, Ohio	$1.95*	$1.90*	Universal, Pa.	$2.00	$1.95
Hannibal, Mo.	2.00	1.95	Northampton, Pa.	1.90	1.85	Waco, Tex. (Plus 9c. tax in Tex.)	1.85	1.80
Independence, Kans.	2.00	1.95	Richard City, Tenn.	2.00	1.95	Montreal¡City (Discount 10c. per bbl. 20 days)	1.78	1.78
			Steelton, Minn.	2.10	2.05			

* Destination price base effective Feb. 22, 1947

PAVING BRICK, BLOCK, ASPHALT, ROAD OILS — F. O. B. CITY

	PAVING BRICK AND BLOCK			PAVING ASPHALT — Per ton, less than 80 penetration		ASPHALT BINDERS—FLUXES — Per gal., 80–300 penetration		CUTBACK ASPHALT — Per ton		ROAD OIL — Per gal.	ASPHALT EMULSION (Quick-breaking) — Per gal.	
	Granite per M lots of 50,000 4x4x8 in.	Brick per M 3x4x8½ in. carload lots	Wood per sq. yd. 3½ in. 16-lb. treat	Tank car	Drums	Tank car	Drums	Tank car	Drums	Tank car	Tank car	Drums
Atlanta	$73.00	$35.00	$2.25	$14.00	.....	$0.074	.....	$0.0806*h*	.....	$0.0781	$0.0806	.....
Baltimore	150.00‡	52.70‡	85.00*m*	15.00	$21.00	.06	$0.09	13.00	$23.00	.06	.07	$0.14‡
Birmingham	.....	32.00	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Boston	85.00	59.00	3.75	17.00*o*	29.50*o*	.0723*o*	.1447*o*	.075*ho*	.15*ho*	.07*o*	.0907*o*	.18*o*
Chicago	150.00‡*y*	68.00/70.00*et*	2.97/4.10*dt*	17.50/18.50*b*	25.00/26.00*b*	16.50*bg*	24.00/24.50*bg*	.08/.0825*bh*	.165/.1675*bh*	.065/.0675*b*	.0925/.1025*b*	.14/.165*b*
Cincinnati	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Cleveland	150.00	47.00*t*	3.43*v*	21.50	32.00	21.50*g*	32.00*g*	.095*h*	.20*h*	.10	.1175	.22
Dallas	*l*	40.00	*l*	16.95	29.15	.0686	.1225	20.00	37.60	.05	.0675	.....
Denver	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Detroit	.....	63.00*x*	.....	20.00	26.00	18.40*g*	24.40*g*	.0811*h*	.128*h*	.075	.1085	.1522
Kansas City	.....	40.00	.....	17.00	24.00	16.00*g*	23.00*g*	.08*h*	.13*h*	.....	.12	.16
Los Angeles	*l*	60.00	*l*	9.50*b*	24.00*b*	10.00*bg*	24.50*bg*	10.00*b*	.....	.04*b*	.10*b*	.20*b*
Minneapolis	.....	.....	2.39*d*	22.00	31.00	17.00*g*	28.00*g*	21.00	31.00	.08	.09	.15
Montreal	100.00	.....	.....	16.60*k*	24.25*k*	11.60*kp*	14.85*kp*	11.50*kp*	13.50*kp*	.08*kj*	.135*k*	.188*k*
New Orleans	.....	.....	.....	13.50*a*	.....*s*	12.50*g*	.....*s*	6.75	.....*s*	.055	.08	.13*n*
New York	.....	.....	2.50*d*	20.68	32.85*s*	19.68*g*	38.68*g*	.0857*h*	.1669*h*	.0807	.0855	.1643
Philadelphia	150.00	62.00	4.06	19.00	.....	17.00	.....	.08*h*	.....	.....	.....	.....
Pittsburgh	142.00	42.00	3.90	20.00	30.00	.10	.20	22.00	34.00	.08	.09	.18
St. Louis	.....	42.00	.....	17.00	23.00	16.00*g*	22.00*g*	.075/.08*h*	.165/.17*h*	.065/.07	.095/.105	.145/.1675
San Francisco	.....	54.00*c*	.....	13.00	26.50*w*	13.00*g*	.....	13.50	.....	.....	.0525	.1225
Seattle	.....	.....	.....	13.00*i*	27.00*i*	9.50*ig*	.....	13.50*i*	17.50*i*	12.50*ig*	.0525*i*	.0625*s*

‡ Delivered. *a* F.o.b. Baton Rouge. *b* F.o.b. Refinery. *c* 2½ x 8½ x 4 in. *d* 2-in. interior block, 6-lb. treatment. *e* 3½ x 4 x 8½. *g* Per ton. *h* Per gallon. *i* F.o.b. Martinez. *j* Shipped in drums. *k* Tax included. *l* Not used. *m* Per thousand. *n* 55 gal. drums. *o* Price at plant. *p* Per 100 gal. *s* Drums not available. *t* Truck deliveries in Greater Cleveland. *w* Shipped in double head wood barrels. *v* 3 in. block. *x* Truck deliveries in Detroit $75.00. *y* Carload lots.

IRON AND STEEL PRODUCTS — BASE MILL PRICES

	STRUCT. SHAPES–PLATE†	REINF. BARS* billet *be†*	RIVETS* ½-in. structural†	WIRE NAILS* Base *df*	SHEET PILING* Base†	STEEL RAILS* Per Net Ton Standard	Light	Re-rolled	TRACK SUPPLIES†* Angle Bars	Std Spikes *c*	Tie Plates *c*	Track Bolts
Birmingham	$2.80	$2.45	$5.25	$3.75/4.50	....	$50.00	$57.00	Not	$3.00	$3.65/4.50	$2.80	$6.50
Chicago	2.80	2.45	5.25	3.75/4.50	$3.00	.....	.....	avail-	3.00	3.65/4.50	2.80	6.50
Pittsburgh	2.80	2.45	5.25	3.75/4.50	3.00	50.00	57.00	able	3.00	3.65/4.50	2.80	6.50
Buffalo	2.80	2.45	.....	....	3.00	.....	.....	....	....	....	2.80	....
Cleveland	....	2.45	5.25	3.75/4.50	....	.....	.....	....	....	....	....	....
Youngstown	....	2.45	....	....	....	.....	.....	....	....	3.65/4.50	....	....
Detroit	....	....	....	....	....	.....	.....	....	....	....	....	....
Gulf ports	....	....	....	....	....	.....	.....	....	....	....	....	....
Geneva	2.675†*	....	....	....	....	.....	.....	....	....	....	....	....
Los Angeles	3.17/3.41†*	3.025†	....	....	....	.....	.....	....	....	....	....	....

† Delivered. *b* Rail steel same as billet prices. *c* Other basing points include Portsmouth, O., Weirton, W. Va., St. Louis, Kansas City, Minnequa, Colo., and Pacific coast ports, on tie plates alone. Steelton, Pa., on spikes alone, Lebanon, Pa., Richmond, Va. *d* Add switching charge $18 per cl. *e* Mill lengths. Add 50¢ for cut lengths. *f* Per 100 lbs.

*** August increase not shown in these prices.**

IRON AND STEEL PRODUCTS — F. O. B. WAREHOUSE, PER 100 LBS., BASE PRICE

August increase not shown in these prices	STRUCTURAL SHAPES Per 100 lb. base price	REINFORCING BARS *g* Per 100 lb., base price *u* 5 tons to carload lot *b* New billet	Rail steel	Add Switch	$/cwt. for Del.	EXPANDED METAL LATH *k* Per 100 sq. yd., carload lots Std. diamond mesh, 3.4 lb.	3.4 lb.	WELDED FABRIC REINFORCING Per 100 sq. ft., carload lots 4x16 in., No. 5 & 10 wires	4x12 in., No. 8 & 12 wires	6x6 in., No. 6 & 6 wires Per 100 s. f.	SHEET PILING Per 100 lb. base price
Atlanta	$4.65†	$4.75†	$4.75†	$.025	$.10	$31.00	$33.00	$2.00	$1.50	$2.12	....
Baltimore	4.25	3.635*l*	....	....	.10	29.00	31.00	1.88	1.42	2.00	$4.25
Birmingham	4.05	3.50	3.50	.05	.10	37.50*p*	40.50*p*	1.98	1.49	2.10	....
Boston	4.47†	4.194†	3.39*ca*	20 C.L.	.10/.15	26.00	28.00	1.94	1.46	2.05	3.443*k*
Chicago	4.10	3.90	3.90	.05	.05	24.00†	26.00†	1.85	1.40	1.96	3.07*i*
Cincinnati*	4.444†	3.469†*c*	3.469†*c*	....	....	35.00†*s*	36.00†*s*	1.87	1.41	1.96	3.34*d*
Cleveland	4.31*l*	3.30*v*	....	.025	.10	26.00	28.00	1.84	1.40	1.95	....
Dallas	6.72	5.50	5.50	....	....	29.15	31.35	2.11	1.57	2.22	....
Denver	5.50	4.97*e*	....	....	....	36.00	41.00*q*	2.15	1.60	2.28	....
Detroit	4.42†	3.591	3.591	....	.10	30.00*x*	32.00*y*	1.86	1.41	1.97	3.3193*yl*
Kansas City	4.85	3.35*aad*	3.25*aad*	.0	.05	30.00	32.00	1.96	1.48	2.08	3.0826*a*
Los Angeles	5.20*f*	3.025	2.875	.03	.05	23.00	27.50	2.11	1.57	2.24	5.50*l*
Minneapolis	4.434†	4.224*dn*	4.224*dn*	.0	.10	26.50*k*	28.50*k*	1.98	1.49	2.10	3.47*k*
Montreal	4.55*i*	4.20*i*	4.20*i*	....	....	36.00*h*	38.70*h*	2.87	3.54*i*	2.96*im*	73.00*jd*
New Orleans	....	4.08*ok*	....	.05	.10	27.50	29.50	2.00	1.50	2.12	.....
New York	4.17*r*	3.85	....	....	15/.20	30.50*st*	32.505*st*	2.13	1.50	2.19	3.00*s*
Philadelphia	3.97	4.24	....	....	....	22.50†	24.75†	1.89	1.43	2.00	3.41
Pittsburgh	4.10	4.10	4.10	.05	.10	26.00	29.80	1.77	1.35	1.88	4.50
St. Louis	4.249†	3.89*cbb*	3.89*cbb*	.0	.05	34.00†	36.00†	1.87	1.42	1.97	....
San Francisco	4.90	4.13	....	....	....	29.50	33.00	2.11	1.57	2.24	4.50
Seattle	3.368*e*	3.368*e*	....	....	....	43.00*w*	44.00*w*	2.11	1.57	2.24	4.37*e*

† Delivered. *a* Mill prices. *b* 1–5 tons, add 35c. Less than 1 ton, add 50c. *c* 20 tons or over base. *d* Mill price plus freight. *e* F.o.b. customer's spur. *f* Includes delivery in free delivery zone. *g* High scrap steel prices cut former 15c. differences between new billet and rail steel in many mills. *h* List price. Dominion tax exempt. Provincial and Municipal tax extra. *i* Plus Dominion, Provincial and Municipal sales tax. *j* Price per ton. *k* F.o.b. city. *l* Intermediate. *m* Per sq. yd. *n* 5 to 8 tons base. *o* 5 to 15 tons base. *p* Deliveries of 5000 sq. yd. or less. *q* Standard ribbed. 4 lb per sq. yd. *r* 5 tons or over. *s* LCL. *t* Asphalt coated. *u* Note: Revised size extra—1 in., 1¼ in., 1½ in. 10¢; ¾ in. and ⅞ in. 15¢, ½ in. 20¢, ⅜ in. 35¢, ¼ in. 55¢, ⅛ in. $1.30. *v* Under 20 tons. $3.14 for over 20 ton lots. *w* Copper bearing. *x* 2.5 lb. per sq. yd. *y* $.0093 transportation tax included. *z* Copper alloy. *aa* 20 tons base. *bb* F.o.b. trucks at warehouse. * Jan.-June, 1947 prices now available.

PLUMBING, HEATING, WATER, SEWER AND DRAIN PIPE

	C. I. PIPE Per net ton f.o.b. 6 in. to 24 in. *a*	VITRIFIED SEWER PIPE Per foot, Delivered ASTM C13–44T std. 8 in. s.s.	std. 12 in. s.s.	24 in.	36 in.	CLAY DRAIN TILE ASTM C4-24 Per 1,000 ft., carload lots, f.o.b. 6 in.	8 in.	CONCRETE SEWER PIPE Per ft., delivered; ASTMC 14–41 12 in.	24 in.	WROUGHT STEEL PIPE (Full standard weight, f.o.b. destination *s*) 1 to 3 in., Butt Weld Black %	Galv. %	3½ to 6 in., Lap Weld Black %	Galv. %
Atlanta	$79.78	$0.43	$0.67	$3.39	$7.00	$114.00	$140.00	$0.45	$2.00	53.2	40.2	50.7	37.2
Baltimore	84.10	.35	.60	2.70	7.25	160.00	200.00	.85	2.25	56.9	43.9	54.4	40.9
Birmingham	74.50	.375	.675	3.06	....	210.00†	375.00†	.75	....	53.2	40.2	50.7	37.2
Boston	86.70	.392*uvx*	.756*uvx*	3.465*uvy*	8.7125*uvy*	150.60	233.40†	.53*h*	2.04*h*	55.2	42.2	52.7	39.2
Chicago	85.06	.54	1.04	4.12	12.80	200.00†	270.00†	.65	2.25	59.0*t*	46.0*t*	55.5*t*	42.0*t*
Cincinnati*	83.86	.378	.729	4.00	12.00	155.00†	240.00†	.54	1.98	57.4	44.4	54.9	41.4
Cleveland	85.54	.329	.6345	2.79	7.38	121.00	190.00	.58	2.25	59.65	46.65	57.15	43.65
Dallas	87.28	.375	.675	2.70	6.20	109.00	131.00	.45	1.45	51.3	38.3	48.8	35.3
Denver	92.12	.38	.68	2.84	....	154.00	295.00	.64	2.25	49.4	36.4	46.7	33.2
Detroit	85.54	.455	.8775	3.69	8.50	170.00†*m*	260.00†*m*	.50	1.90	57.9	44.9	55.4	41.9
Kansas City	86.62	.345	.625	2.48	7.00	175.00	312.00*m*	.50	1.90	54.7	41.7	51.8	38.3
Los Angeles	98.50	.414†	.745†	2.988	7.47	157.00	260.00	1.25	2.50	....	....	....	....
Minneapolis	88.60	.51*mo*	.98*mo*	3.95*mo*	....	.....	.....	1.05*h*	2.56*h*	54.8	41.8	51.9	38.4
Montreal	78.20	.68*z*	1.20*z*	3.94*z*	6.38*ez*	.48*paa*	.68*paa*	72.00*jkaa*	218.00*jkhaa*	....	....	....	....
New Orleans	82.18	.40	.72	3.06	....	220.00*bb*	.....	.55	1.95	52.8	39.8	50.3	36.8
New York	83.30	.59	1.09	4.24	10.79	.....	.....	.90	2.25	56.2	43.2	53.7	40.2
Philadelphia	81.70	.50	.95	3.95	9.75	220.00	275.00	1.05*h*	2.75*h*	56.7	43.7	54.2	40.7
Pittsburgh	86.02	.357*m*	.6585*m*	2.70*m*	6.625*m*	126.20	197.40	1.05*h*	2.50*g*	60.0*t*	47.0*t*	57.5*t*	44.0*t*
St. Louis	83.38	.40*n*	.72*n*	2.88*nb*	6.53*nb*	.....	.....	1.10*il*	2.15*hl*	56.6	43.6	53.2	39.7
San Francisco	98.50	.4375*d*	.7875*d*	3.15*d*	7.875*d*	159.00*dl*	265.00*dl*	.69	2.85	....	....	....	....
Seattle	100.30	.45*b*	.81*b*	....	....	72.50*c*	.....	.595*f*	1.80*fcc*	....	....	....	....

† Delivered. ‡ F.o.b. *a* B. & S. class B and heavier, C.L lots, Burlington, N. J. (base) $79.50. Based on existing freight rates; subject to rate change. Gas pipe and class A, $5 per ton additional. 4 in., $5 per ton additional, 30 in. and larger, usually $1 per ton less. *b* Extra strength ASTM C 200–44T. *c* 4-in. *d* SS361-A. *e* 30 in. *f* Less 2% for cash. *g* Culvert pipe. Reinforced, ASTM C76–41. *h* Reinforced. ASTM C75–41. *i* Reinforced. ASTM C76-37. *j* Centri-spun. *k* Per 100 feet. *l* F.o.b. plant. *m* Truck delivery. *n* Less 3% for cash. *o* Since carload lots are not available at this time, listed price is based on LCL (no minimum). *p* Less than 5 ton loads, price per foot. *s* Discounts from standard list consumers carload prices. Base price approx. $200 per net ton. List prices per ft.: ½ in., 8½c.; ¾ in., 11½c.; 1 in., 17c.; 2 in., 37c.; 2½ in., 58½c.; 3 in., 76½c.; 4 in., $1.09; 6 in., $1.92; 3 percent tax on transportation costs not included. *t* Within switching limits. *u* ASTM C13-40. *v* F.o.b. city. *x* 2 ft. lengths. *y* 3 ft. lengths. *z* CESA A60–1941 specifications used. *aa* No standard specifications in Canada. *bb* Freight allowed to destinations in city. *cc* July price was list price. Contractor allowed 10% discount. * Jan.-June, 1947 prices now available.

WROUGHT IRON PIPE: List prices per ft. same as wrought steel pipe. Discount for Pittsburgh base. Butt weld — 1 in. and 1¼ in. black, 34, galv., 16; 1½ in. black, 38, galv., 18½; 2 in. black, 37½, galv., 18. Lap weld — 2½ in. to 3½ in. black, 31½, galv., 14½; 4½ in. to 8 in. black, 32½, galv., 17. Freight rates to destination to be added to name delivered price.

LUMBER, TIMBER, PLYWOOD—PER M FT., B.M., CARLOAD LOTS F. O. B.

	SHORT LEAF YELLOW PINE AND DOUGLAS FIR — All S. L. Y. P. is No. 2 common or better and for No. 1 N. C. Box. (Prices in Bold Face) — All Fir planks No. 2 common, Fir timber is No. 1 common. Lengths up to 20 ft. (Prices in italics)									LONG LEAF Y. P. Merchantable grade up to 20 ft.		PLYWOOD Rail freight increment (See note for base price)	
	1x6 S4S	1x8 S4S	2x4 S4S	2x6 S4S	2x8 S4S	2x10 S4S	3x12 Rgh	6x12 Rgh	12x12 Rgh	2x12 Rgh	12x12 Rgh	3/8"	3/4"
Atlanta	$72.00	$72.00	$62.00	$62.00	$62.00	$62.00	$82.00	.....	.....	.....	.....	$18.60	$22.70
	85.00	*85.00*	*95.00*	*95.00*	*95.00*	*95.00*	*85.50*	*$85.50*	*$85.00*	.....	.....	.....	.....
Baltimore	78.00	80.00	80.00	78.00	82.00	86.00	95.00	.....	.....	160.00	150.00	19.05	23.25
	88.00	*90.00*	*95.00*	*92.00*	*94.00*	*94.00*	*100.00*	*100.00*	*100.00*	.....	.....	.....	.....
Birmingham	87.50	87.50	87.00	86.00	87.00	90.00	110.00	.....	.....	110.00	112.50	18.15	22.15
[1]	*92.50*	*92.50*	*92.00*	*91.00*	*92.00*	*95.00*	*114.00*	*97.00*	*98.00*	.....	.....	.....	.....
Boston	70.00[3]	72.00[3]	66.50[3]	68.50[3]	70.50[3]	74.50[3]	70.25[3]	.....	.....	.....	.....	19.05	23.25
	64.75i	*64.75i*	*62.75i*	*63.25i*	*62.75i*	*62.75i*	*60.50i*	*59.50i*	*59.50i*	*59.50i*	*59.50i*	.....	.....
Chicago ‡	82.00	82.00	75.00	75.00	75.00	85.00	85.00	.....	.....	115.00	115.00	15.60	19.00
‡	*87.00*	*87.00*	*80.00*	*80.00*	*80.00*	*90.00*	*90.00*	*90.00*	*90.00*	.....	.....	.....	.....
Cincinnati	70.00	72.50	75.00	74.00	75.00	80.00	104.00	.....	.....	90.00	120.00	18.15	22.15
Cleveland *k*	100.00	100.00	100.00	100.00	100.00	105.00	.....	.....	.....	130.00	150.00	18.50	22.60
k	*115.00*	*115.00*	*115.00*	*115.00*	*115.00*	*115.00*	*125.00*	*125.00*	*125.00*	.....	.....	.....	.....
Dallas	59.00	59.00	56.75	57.75	59.00	61.50	61.00	.....	.....	94.75	91.00	15.60	19.00
Denver	*93.50*	*93.50*	*97.00*	*97.00*	*95.50*	*96.50*	.....	.....	.....	.....	.....	11.60	14.15
Detroit	75.00	75.00	73.00	72.00	73.00	76.00	85.00	.....	.....	80.00	98.00	18.15	22.15
	93.00	*93.00*	*92.00*	*92.00*	*93.00*	*95.00*	*100.00*	*100.00*	*105.00*	.....	.....	.....	.....
Kansas City *a*	77.40	77.40	75.60	75.00	75.00	77.40	95.00	.....	.....	105.00	110.00	13.80	16.80
	79.20	*79.20*	*78.75*	*78.75*	*77.00*	*78.00*	*76.50*	*95.00*	*95.00*	.....	.....	.....	.....
Los Angeles *a*	*78.30*	*78.30*	*79.20*	*80.00*	*78.30*	*78.30*	*91.00*	*91.00*	*80.00*	.....	.....	11.15*gh*	13.55*gh*
Minneapolis ‡*b*	102.00[3]	102.00[3]	.....	.....	.....	.....	.....	.....	.....	.....	.....	13.80	16.80
‡*b*	*98.00*	*98.00*	*98.00*	*98.00*	*98.00*	*100.00*	*125.00*	*125.00*	*125.00*	.....	.....	.....	.....
Montreal *e*	69.00	70.00	64.00	68.00	70.00	75.00	.....	.....	.....	.....	.....	.....	.....
	97.00	*97.00*	*97.00*	*97.00*	*97.00*	*97.00*	*87.00*	*87.00*	*87.00*	.....	.....	.....	.....
New Orleans	60.00	60.00	60.00	60.00	60.00	65.00	105.00	.....	.....	100.00	105.00	15.60	19.00
	61.00	*61.00*	*58.50*	*58.50*	*58.50*	*54.50*	*60.00*	*60.00*	*90.00*	.....	.....	.....	.....
New York ‡	Range from $85.00 to $90.00						105.00/115.00	.....	.....	.....	.....	19.05	23.25
‡	.....	.....	*Range from $97.50 to $102.50*				*95.00/105.00*	*102.50/110.00*	*102.50/110.00*	.....	.....	.....	.....
Philadelphia	110.00	110.00	110.00	110.00	110.00	110.00	110.00	.....	.....	150.00	150.00	19.05	23.25
	120.00	*120.00*	*120.00*	*120.00*	*120.00*	*120.00*	*120.00*	*120.00*	*120.00*	.....	.....	.....	.....
Pittsburgh	59.40	61.80	71.35	63.60	69.45	73.10	84.85	.....	.....	130.60	141.00	18.80	22.90
	77.60	*76.70*	*74.70*	*73.90*	*73.80*	*74.85*	*91.85*	*96.85*	*96.85*	.....	.....	.....	.....
St. Louis ‡*j*	86.00	88.00	87.00	87.00	87.00	91.00	108.00	*130.00*	*130.00*	.....	.....	15.60	19.00
‡*j*	*110.00*	*110.00*	*105.00*	*108.00*	*108.00*	*108.00*	*113.00*	.....	.....	.....	.....	.....	.....
San Francisco *d*	*69.00*	*69.00*	*69.00*	*69.00*	*67.00*	*66.00*	*70.00*	*70.00*	*70.00*	.....	.....	8.40*g*	10.25*g*
Seattle	*75.00i*	*75.00i*	*75.00i*	*75.00i*	*75.00i*	*75.00i*	*75.00i*	*75.00i*	*75.00i*	.....	.....	.....	.....

Bold Face type, Southern Pine. *Italics, Douglas Fir.* [1] Long leaf. [3] Spruce. [a] Western Pine, No. 3 Common. [b] Norway Pine. ‡ Delivered. *a* Yard prices. *b* Retail prices, less than CL. *c* 5 M ft. or less. *d* Sales through wholesale distribution yard (F.o.b. purchaser's truck or carrier, San Francisco paid). *e* Tax exempt. *g* Lower rate by water shipment. *h* 50,000 lb. minimum. *i* No. 1 common. *j* Delivered in 5000 ft. lots. *k* These are rerail yard prices. Lumber is no longer available on the base previously quoted. Less 2% for cash. Truck lots.

Note: Special concrete form grade Fir Plywood, 4' by 8' panels, 5-ply, sanded 2 sides, water resistant glue, carload lots, delivered per 1,000 sq. ft. surface. Seattle base price on ⅜", $162.50; on ½", $182.50; price includes oiling and sealing charges. For other centers add rail freight increment from table on proper size. For resin dipped treatment, add $10.50 per M.

GLASS, EXPLOSIVES, CHEMICALS

	WINDOW GLASS — Discounts from jobbers list, Jan. 16, 1946 — Single or Double Thickness — A quality	B quality	EXPLOSIVES — Per lb. 40% Ammonia Gelatin in 50 lb. cases delivered in 200 lb. lots*	
Atlanta	76%	76%	$0.195	
Baltimore	70–10%	71–10%	.195	
Birmingham	68%	68%	.15	
Boston	77%	78%	.195	
Chicago	68%*e*	68%*e*	.195	
Cincinnati**	67&10%*g*	67&10%*g*	.195	Price of 60% Ammonia Gelatin is $0.0125 per lb. higher than 40%
Cleveland	67–10–10%	67–10–10–10%	.195	
Dallas	67%*e*	68%*e*	.2075	
Denver	68%	68%	.20	
Detroit	77%	76%	.195	
Kansas City	68.10%*g*	68.10%*g*	.195	
Los Angeles	86%*d*	88%*d*	.2025	
Minneapolis	68%	68%	.19	
Montreal	40–5%*ab*	40–10–5%*ab*	.2125	
New Orleans	68%	68%	.205	
New York	73%	74%	.265*f*	
Philadelphia	69%	70%	.195	
Pittsburgh	77–10%	77–10%	.1675	
St. Louis	70–10%	70–10%	.20	
San Francisco	66%	73%	.20	
Seattle	59%	60%	.2025	

a Discount from list, Sept., 1939; sales tax included, but 6% tax exemption not allowable for. *b* Single thickness. *d* Discount from jobbers list Sept. 15, 1928. *e* Discount from list of Jan. 29, 1947. *f* In borough of Kings, Queens and Richmond, and in Manhattan south of Canal St., add delivery charge of $6.00 per trip. *g* Discount from list of Aug. 15, 1938.

* Urban prices influenced by service charges or local storage and delivery regulations do not consistently reflect quantity prices in less congested areas. ** Jan.-June, 1947 discounts now available.

40% Ammonia Gelatin price ranges in other than urban areas, per lb. (except Seismograph Grades)

	C/L 20,000 lb. net	Tons	200 lb. lots
E. of the Miss., except Fla. and Me.	$0.15	$0.175	$0.195
W. of Miss. to Rocky Mtn. States, Fla. and Maine.	.155 –.1625	.18 –.1925	.20 –.2125
Rocky Mtn. States	.155 –.1675	.18 –.1975	.20 –.2175
Pacific N. W. States	.1525–.165	.1825–.195	.2025–.215
Pacific S. W. States	.15 –.1575	.18 –.1875	.20 –.2075

PILES, TIES F. O. B.

PILES

Prices per linear foot, fir and pine, bark on, f.o.b. cars, New York. Fir based on Wash. and Ore. points to New York shipping area; pine based on freight from Norfolk.

Dimensions	Points	Length	By Rail — Pine*	Fir
12-in. at butt	6-in.	30 to 50-ft.	$0.34	....
12-in.— 2-ft. from butt	6-in.	50 to 59-ft.	.35	....
12-in.— 2-ft. from butt	6-in.	60 to 69-ft.	.36	....
12-in.— 2-ft. from butt	6-in.	90 to 100-ft.	....	.57
13-in.— 3-ft. from butt	5-in.	91 to 100-ft.	....	.62
14-in.— 2-ft. from butt	6-in.	50 to 69-ft.	.41	.66
14-in.— 2-ft. from butt	6-in.	70 to 79-ft.	.43	.60
14-in.— 2-ft. from butt	5-in.	80 to 85-ft.	.54	....
14-in.— 2-ft. from butt	5-in.	85 to 89-ft.	.57	....
14-in.— 2-ft. from butt	5-in.	90 to 100-ft.	....	.67

* Pine piling over 80-ft. available only in limited quantities.

RAILWAY TIES

Prices f.o.b. per tie for carload lots:		6'x8"x8' Untr.	6'x8"x8' Tr.	7'x9"x8'6" Untr.	7'x9"x8'6" Tr.
Boston	Oak	$1.45	.....	$2.00	.....
	Pine	1.35	$3.05*a*	1.90	$4.00*a*
New York	S. L. Sap Pine	1.65	2.85	2.00	3.30
	Mixed Oak	1.80	3.05	2.50	3.60
Birmingham	Hardwood	1.00	1.60*a*	....	2.25*a*
Chicago	Red Oak	....	2.65/2.75*a*	....	3.55/3.70*a*
Los Angeles	Douglas Fir	2.10	3.35*a*	3.00	4.80*a*
Philadelphia	Red Oak	2.25	3.05*ag*	3.00	4.15*ag*
St. Louis	White Oak	1.80	....	2.50	....
	Red Oak	....	2.40*a*	....	3.40*a*
	Sap Pine or Cypress	2.20	....	....	....
San Francisco	Douglas Fir	1.28*ef*	2.56*f*	1.68*bf*	3.36*caf*
Montreal	Birch or Maple	....	1.65	1.04	....

Tr.—Treated; Untr.—Untreated. *a* Creosoted. *b* 7" x 9" x 8'. *c* Empty cell. *e* Green. *f* F.o.b. cars. *g* January, 1943 price, none later available.

CHEMICALS

Water, sewage treatment, road work, f.o.b. carlots, New York

Bleaching powder in drums f.o.b. works, per 100 lb.	$2.75– 3.00
Chlorine cylinders, liquid, per lb. delivered	.0675
Calcium chloride, 77–80%, flaked, 100-lb. paper bag, del'd, ton	21.50–38.00
Silicate of soda, 52 deg., in drums, f.o.b. works, per 100 lb.	1.55
Soda ash, 58%, in paper bags, per 100 lb. dense	1.28
Sulphate of aluminum, commercial, in 100-lb. bags	1.15–1.30
Sulphate of copper, in bbl., per 100 lb.	7.60

STRUCTURAL CLAY BUILDING TILE, BRICK AND LIME — DELIVERED

	STRUCTURAL CLAY TILE PARTITION — SCORED Per M. lots of 2,000 pieces or over, 3x12x12 in.	4x12x12 in.	8x12x12 in.	STRUCTURAL CLAY TILE — LOAD BEARING — SCORED Per M. lots of 2,000 pieces or over, 8x12x12 in.	10x12x12 in.	12x12x12 in.	BRICK Per M. in quantity Common backing	Straight hard	LIME Per ton, In paper, Carload lot. Hydrated finishing	Common hydrated	Pulverized, or lump
Atlanta	.....	.....	.....	.....	.....	.....	$24.00	$24.00	$19.00	$17.50	$17.50
Baltimore	$110.00	$116.00	$208.00	$225.00	$290.00	$320.00	23.75*k*	29.75*k*	22.50	17.50	2.75*m*
Birmingham	97.50	104.00	195.00*c*	231.00	.....	.....	19.50*ff*	21.50*gg*	21.80	17.50	.....
Boston	105.00†	112.00†	210.00†	252.09†	.....	.....	20.00*i*	21.00*i*	21.00†	.....	16.00
Chicago	115.00	122.50	230.00	.....	.....	.....	18.50	19.50	24.00	18.00	.....
Cincinnati*	150.00*j*	160.00*j*	210.00*jdd*	290.00*j*	.....	.....	27.50	27.50	22.00	19.60	.....
Cleveland	99.50	106.00	195.50	.....	.....	.....	24.00	24.00	19.65	17.15	22.15*ee*
Dallas	.....	83.00	.....	.....	.....	.....	18.00	20.00	28.00	22.00	.....
Denver	105.25	119.00	198.25	230.00	263.50	315.35	27.50	.....	34.80*bb*	28.00*bb*	34.00*bb*
Detroit	126.00	134.00	252.00	285.00	370.00	423.00	24.50*f*	26.50*f*	24.00	22.00	22.00
Kansas City	.....	.....	.....	.....	.....	.....	16.00	18.50	34.00	30.00	30.00
Los Angeles	*r*	*r*	*r*	*r*	*r*	*r*	18.00	20.50	21.80	18.80	22.80
Minneapolis	136.50*p*	151.50*p*	270.40*p*	151.50*wp*	.....	.....	21.00*vp*	.....	30.00*bbe*	23.00*bbe*	30.00*bbda*
Montreal	92.50*a*	98.50*a*	196.25*a*	151.50*ag*	.....	294.40*a*	22.16	31.86	12.50*ub*	14.00*u*	8.00*uo*
New Orleans	.....	.....	.....	.....	.....	.....	22.50	.....	21.20	18.00	14.10
New York	103.90	110.80	152.35*c*	166.70*hn*	.....	.....	26.00	.....	32.00	25.50	.....
Philadelphia	112.10	119.60	224.20	269.10	321.20	405.10	24.75	27.75	26.75	17.00	17.00
Pittsburgh	98.50	105.80	181.85	217.30	265.85	303.10	26.00	28.00*y*	19.40	16.90	2.85*m*
St. Louis	101.15	112.95	209.60	220.50	273.60	304.00	26.00*sl*	25.00*s*	.65*aaap*	.50*aaap*	.75*aaap*
San Francisco	124.00	139.50	186.00*dd*	139.50*t*	.....	.....	27.50	.....	22.10	22.10	2.21*m*
Seattle	137.00*cc*	147.00*cc*	.....	147.00*ccw*	.....	.....	28.50	33.50	27.95*s*	27.95*s*	3.28*m*

† F.o.b. *a* Smooth. *b* Per 50 lb. bags. *c* 6 x 12 x 12 in.-3 cell. *d* Pulverized hot. *e* 5% discount for cash. *f* Includes $3.50 per M for truck delivery. *g* 5½ x 8 x 12. *h* F.o.b. Perth Amboy, N. J. *i* F.o.b. warehouse only. *j* Truck load or over. *k* $1.00 discount. *l* Red face. *m* Per bbl., 180 lb. *n* 7½ x-7½ x 12. Speed title. *o* Per bbl., 200 lb. *p* Truck lots. *r* Not used because of earthquake danger. *s* 2% discount for cash. *t* 5½ x 8 x 11½. *u* Tax exempt. *v* Sand lime. *w* 5 x 8 x 12. *y* Stacked. *z* Pebble lime price per 80 lb. sack. *aa* Price per sack. Lime not sold per ton. *bb* L.V.L. *cc* Truck delivery. *dd* 6 x 12 x 12. *ee* Pebble lime. *ff* 80% common. *gg* Select. * Jan.-June, 1947 prices now available.

PAINT, ROOFING — F. O. B. CARLOAD LOTS

	RED LEAD Per 100 lb. in 600-lb. (Approx.) bbl. Dry *a*	WHITE LEAD Per 100 lb. in 100 lb. cases In oil *w*	READY-MIXED PAINT Per gal., drums Graphite *b*	Aluminum *c*	Ferric Oxide *d*	ROOFING SUPPLIES Carload lots f.o.b. factory Rolls, slate surfaced, 85–90 lb. per sq.	Asphalt felt, per 100 lb.	Tar felt, per 100 lb.	Asphalt coating per gal.	Tar pitch 360 lb. bbl. per ton
Atlanta	$18.75	$27.375	$1.75	$2.70	$1.65	$2.06	$2.06	$2.06	$1.00	$36.00
Baltimore	18.50	27.50	2.25	3.50	2.75	2.50	3.00	3.00	.50	30.00
Birmingham	18.75	27.375	4.40	4.52	....	2.84	2.70	2.70	.40	34.50
Boston	18.50	27.00	1.75	2.50	2.31	2.00‡*h*	3.30‡*q*	3.30‡*q*	.25‡	21.00
Chicago	18.50	27.00	....	....	....	1.75‡	2.55‡*o*	2.55‡*o*	....	29.00‡
Cincinnati*	18.50	27.00	.. :	3.15	1.90	2.20	2.26*o*	2.26*o*	37	34.00
Cleveland	18.50	27.00	3.00	3.00	3.00	2.21	2.26*o*	2.26*o*	.31*y*	33.00
Dallas	18.50	27.00	....	4.05	....	2.69*q*	3.00*q*	3.15*q*	.90	45.00
Denver	18.50	27.50	2.75	4.35	2.50	2.625	2.625*q*	2.625*q*	.365	32.40
Detroit	18.50	27.00	2.00	3.00	1.75	2.25	2.25	2.25	.50	25.00
Kansas City	18.50	27.125	3.30*g*	3.55*g*	3.16*g*	3.00	3.25	3.25	.67	.....
Los Angeles	18.75	27.50	3.20	4.60	4.00	2.80	1.90*e*	*l*	.60	*l*
Minneapolis	18.50	26.13*m*	....	....	....	2.10*im*	2.15*him*	2.15*him*	.37*m*	28.00*rm*
Montreal	.....	.....	2.90*p*	4.20*p*	3.62*p*	2.85*t*	2.58*tf*	2.07*tf*	.68*t*	1.85*kt*
New York	18.50	27.00	3.45	....	3.45	2.10	2.15*o*	2.15*o*	.30*s*	26.00
Philadelphia	18.50	27.00	1.75/2.00	2.40	1.70	2.54	2.94	2.97	.37	26.00
Pittsburgh	18.50	27.00	1.98	2.50	1.90	2.32	2.37*o*	2.37*o*	.37	30.00
St. Louis	18.50	27.00	....	....	....	2.50	2.50	2.50	.45	29.00
San Francisco	18.75	27.25	1.80	2.75*n*	1.35	2.27*x*	2.30*ua*	....	.38*bb*	.....
Seattle	18.75	27.50	2.95*m*	2.95*m*	....	3.00*mq*	3.07*hm*	....	.48*m*	35.00*jm*

‡ Delivered. Note: Red lead in oil 50c higher than white lead in oil. *a* Red lead prices change frequently due to pig lead price changes. *b* U. S. War Dept. Spec. 3-49A. *c* ASTM Spec. D266-31. *d* 80% minimum ferric oxide. *e* 15 lb. per square. *f* Per 432 sq. ft. *g* 55 gal. can. *h* Per roll. 65 lb. *i* Minneapolis and vicinity. *j* Asphalt pitch. *k* Per cwt. *l* Not used. *m* 1% discount for cash. *n* May, 1941 price. *o* Per 60-lb. roll. *p* Tax included. *q* Per 90-lb. roll. *r* F.o.b. factory Chicago. *t* Federal tax included. *w* Price to large paint contractors is $1.25 less. *x* Mineral surfaced. *y* 55-gallon container. *z* Drums. *aa* Approximate cost per 100 lbs. *bb* 55-gallon drums. July price was $.3395. * Jan.-June, 1947 prices now available.

SKILLED AND COMMON WAGE RATES — PER HOUR

	Bricklayers	Carpenters	Struct. Iron Workers	Hoisting Engineers	Plasterers	Electrical Workers	Steamfitters	Common Labor Building	Common Labor Heavy Const
Atlanta	$2.00	$1.65	$1.75	$1.75	$2.00	$1.80	$2.00	$0.75	$0.85
Baltimore	2.25*b*	1.95	2.15	1.625/2.00	1.90	2.00	2.00	1.10	1.10
Birmingham	2.00	1.625	1.75	1.50/1.75	1.875	2.00	1.875	.75	.85
Boston	2.15	1.90	1.95	2.25	2.00	2.15	2.00	1.40	1.40
Chicago	2.20	2.15	2.20	2.15	2.225	2.15	2.15	1.50	1.50
Cincinnati**	2.25	1.975	2.10	2.00	2.125	2.00	2.125	1.25	1.15
Cleveland	2.25	2.125	2.25	1.875/2.125	2.125	2.125	2.125	1.50	1.40
Dallas	2.00	1.625	1.75	1.75	1.875	1.875	1.875	.90	.90/1.25
Denver	2.25*b*	1.875	1.70*b*	1.875*b*	2.25	....	....	1.275	1.35
Detroit	2.25	2.025	2.25	2.25	2.25	2.25	2.165	1.425	1.425
Kansas City	2.25	1.90	2.05	2.125	2.25	2.025	1.875	1.325	.90
Los Angeles	2.25	1.90	2.25	2.00	2.50	1.875	2.00	1.25	1.25
Minneapolis	2.075	1.80	2.00	1.85	2.25	2.06	2.00	1.30	1.30
New Orleans	1.9375	1.50	1.875	1.75	1.875	2.00	2.05	.80	.80
New York	2.75*b*	2.50*b*	2.50	2.50*b*	3.00*b*	2.25	2.30	1.50	1.50
Philadelphia	2.40/2.50	2.00	2.40	2.25	2.25	2.25	2.25	1.10	1.10
Pittsburgh	2.50	2.25	2.25	2.25	2.25	2.25	2.25	1.15	1.15
St. Louis	2.25	1.95/2.20	2.25	2.40	2.25	2.25	2.125	1.35	1.35
San Francisco	2.25	2.00	2.00	2.00	2.25	2.00	2.25	1.40	1.40
Seattle	2.235	1.935	2.135	1.95	2.235	2.135	2.34	1.535	1.45
Montreal*	1.17	1.06	1.11	1.00	1.17	1.11	1.11	.73	.73

b 7 hr. day. * Cost of living bonus now included in basic wage. ** Jan.-June, 1947 prices available.

MEXICO CITY PRICES

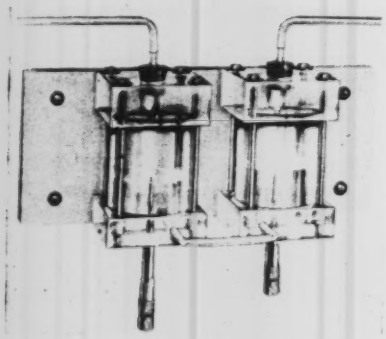
In Pesos, F.o.b. City		June '47	Aug. '47
Common Wages—Building	per hr.	.57	.57
Common Wages—Heavy Const	per hr.	.75	.75
Skilled Labor Wages			
Carpenters	per hr.	1.25	1.25
Bricklayers	per hr.	1.25	1.25
Struct. Iron Workers	per hr.	1.50	1.50
Struct. Steel Shapes 3"-15" x 12 meters	per ton	750.00	850.00
Reinf. Steel, Corr. Rods			
⅜" x 12 meters	per ton	.....	940.00
½" x 12 meters	per ton	.....	895.00
⅝" x 12 meters	per ton	.....	880.00
¾" x 12 meters	per ton	.....	880.00
⅞" x 12 meters	per ton	.....	870.00
1" x 12 meters	per ton	.....	865.00
Gravel, truck load of 3½ cu. meters			
Blue Gravel	per tr. load	35.00	35.00
Rose Gravel	per tr. load	32.00	32.00
Cement, Std. Port. (Toltca)	per ton	120.00	120.00
Lumber			
Mex. Sacred Fir (Oyamel)	per M ft.	300.00	375.00
1st Class Pine	per M ft.	600.00	750.00
2nd Class Pine	per M ft.	.....	450.00

ENR Skilled Average: (Bricklayers, Carpenters, Ironworkers) $2.080. **ENR Common Average:** $1.221.

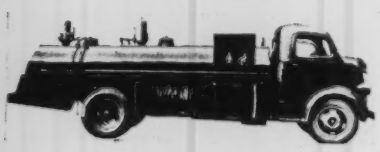
New Aids to the Constructor

MANUFACTURERS' LATEST DEVELOPMENTS IN EQUIPMENT AND MATERIALS

WIRE ROPE LUBRICANT — Leadolene "Klingfast" wire rope lubricant is available in colors which will serve to identify as well as protect wire rope products. Among the properties claimed for "Klingfast" are: unusual resistance to abrasion and corrosion; a high affinity for steel and other metals; high resistance to water, lubricating oils and greases, scale, dusts, and other prevalent forms of contamination; excellent resistance to deterioration or malfunction caused by temperature extremes.—*Brooks Oil Co., Pittsburgh* 19, *Pa.*

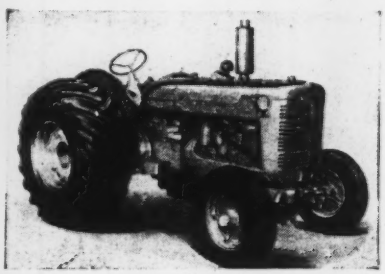


PRECISION HOOK GAGE—A new hook gage, known as the "Dwyer transparent hook gage," is said to exceed in accuracy any in its class yet invented. The device works on the simple principles of the "U" type water column gage. The difficulty of capillary pull on the water columns has been overcome by widening the columns to 2½ in. Measurements are taken from the center of the column by needle-pointed "hooks" which are attached to depth micrometers of a standard make. With the exception of the hooks and micrometers the entire gage is made of an unbreakable, transparent plastic, with no moving parts.—*F. W. Dwyer Mfg. Co.*, 317 *South Western Ave., Chicago, Ill.*

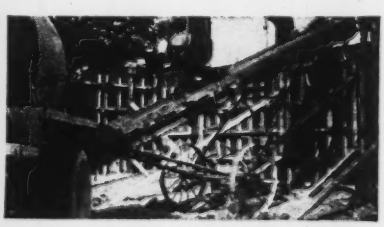


ROOF COATING TANK TRUCK—A roof coating tank truck has a truck body with tank capacity of 800 gal. of roof coating. It is equipped with a Model 105 Davey Auto-Air compressor, driven directly from the truck's engine, which furnishes power for transmittal of coating material from ground level to roofs of any height. A three-man crew can apply 350 to 400 squares of heavy asbestos fibre roof coating daily. Standard truck equipment includes 300 ft. of ¾ in. material hose and similar lengths of ½ in. air hose.—*Davey Compressor Co., Kent, Ohio,* in conjunction with *Acorn Protective Maintenance Co., Ware, Mass.*

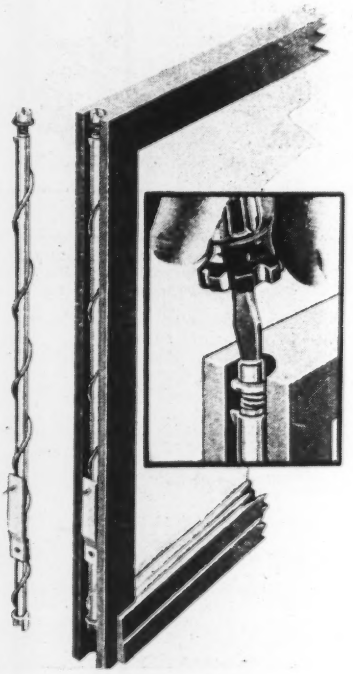
INDUSTRIAL WHEEL TRACTORS—To facilitate off-the-highway movement of scrapers, wagons, and trailers, I.H.C. has developed single rear tires and wheels for its I-9 (55-hp. gasoline engine) and ID-9 (52-hp. diesel engine) industrial wheel tractors. With



this new tire, trailed equipment follows track of tractor without incurring any difficulty in steering or other attendant operations. New, large 18.00x26 single rear tires give same tread as dual-tired units, as well as permitting maximum drawbar pull of 5,500 to 7,500 lb., depending on ground conditions and amount of weight on drive wheels.—*International Harvester Co.*, 180 *N. Michigan Ave., Chicago* 1, *Ill.*



TROUGH CONVEYOR—Handling concrete from ready-mix trucks to point of placement is done speedily by this conveyor, with belt widths ranging from 18 to 24 in. and length of 20 to 40 ft. with vertical heights adjustable from 7 to 11 ft. for 18 in. x 20 ft. unit and from 12 to 21 ft. for machines 40 ft. long. Company also makes sectional conveyors in 35 to 75-ft. lengths.—*A. B. Farquhar Co., York, Pa.*



SASH BALANCE—A new vertical sash balance for double hung sash, to be sold under the trade name Hidalift, has 100 percent concealment with nothing to mar the architectural beauty of a well-designed window. Other features include a spring sealed in the tubing to prevent wear caused by dust; a tension which is easily adjusted without special tools and without removing sash or screws; also a specially designed non-slip clutch which holds the window in continuous perfect balance after the tension is once adjusted.—*The Turner & Seymour Mfg. Co., Torrington, Conn.*

DRY-CLEANER FOR DRAWINGS—Smudges, fingerprints, and dust on drawings, blueprints, maps, and charts can be removed by a preparation named Draw-Kleen. It may be sprinkled on the sheet while the work is being done, to absorb perspiration,

SMITH Impulse Turbines

Impulse runner of *solid-cast* design, an exclusive SMITH advantage.

FOR HIGH HEADS, and wherever the head and water quantities available prohibit the use of reaction-type machines. Ideal for installations in remote localities because of the ease with which the completed unit may be transported. The simplicity of design, facility of operation and greater dependability remove the necessity of skilled operators and attendants. Smith's solid-cast runner design provides the additional advantages of closer spacing of buckets resulting in increased speed and consequently, a decrease in the size of the turbine unit, as well as the generator. Write for your copy of our Bulletin — "Impulse Turbines by SMITH!"

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PITTSBURGH (12)	1281 Reedsdale St., N. S.	CEdar 7780
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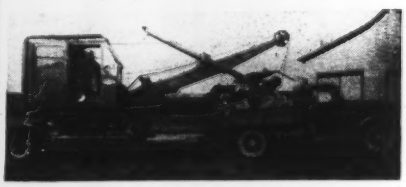
TWIN CITY	2545 University Ave., St. Paul (4), Minn.	NEstor 7311

UNITED STATES STEEL

surface dirt, and pencil smudges, and brushed off easily when the drawing has been completed. It is packaged in a handy 1½ oz. shaker-top can.—*The Craftint Manufacturing Co., Cleveland, Ohio.*

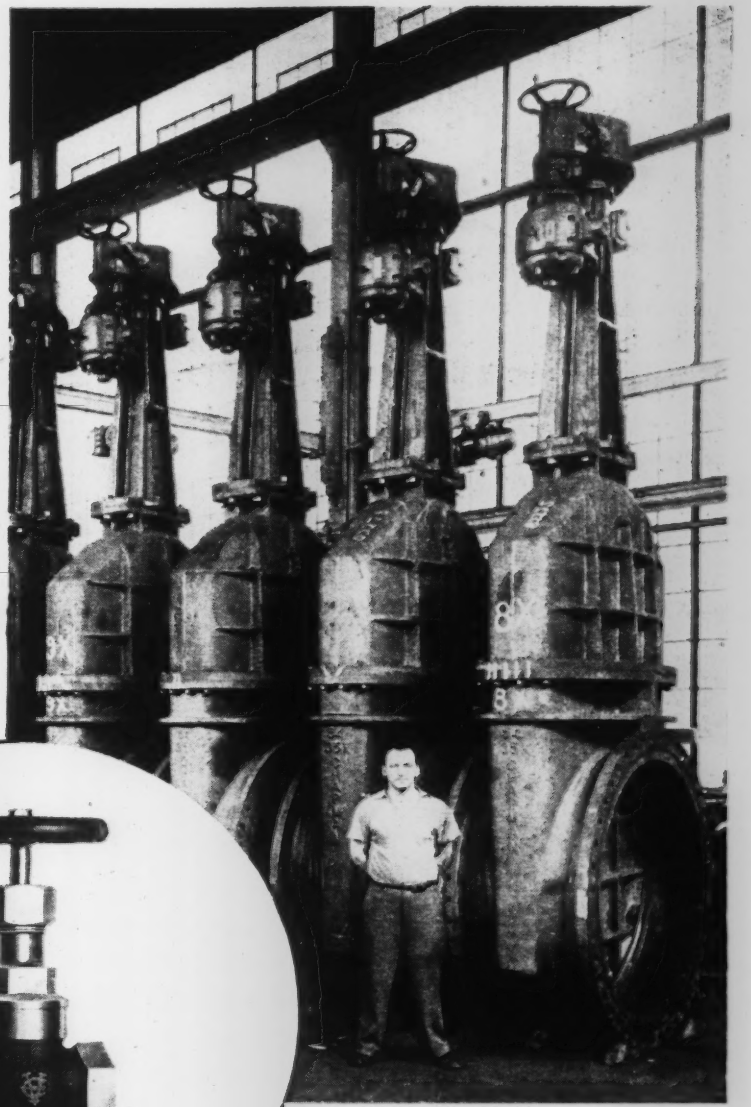
HYDRAULIC LOADER—Loadtrac is attachment for Ford-Ferguson tractor, designed for fast, powerful loading, digging and lifting. Unique design enables greatest hydraulic force to be exerted at "breaking-out" position, at which point it will lift, 2,000 lb. and sustain, at height of 8½ ft., 1,000 lb. It raises to this height in 5 sec. and lowers to ground in 4 sec. Additional attachments available include material bucket, industrial crane, industrial lift-fork, bulldozer, sweep-rake, snow plow, and coal bucket.—*Loadtrac Co., 8 S. Michigan Ave., Chicago 3, Ill.*

HYDRAULIC ROAD SANDER — A unit known as the hydraulic road sander is designed to simplify the problem of sanding icy or snowy streets and roads. It can be attached to the rear of the dump body of any auto truck with a power take-off. With the body elevated, the sand is carried by an agitator to an opening where it falls onto a rotating distributor that spreads the sand, cinders, other chemicals, or abrasives evenly on the highways. A portion of the sand is thrown ahead of the rear wheels, providing traction even while the highway is being sanded.—*Hydro Spreader Corp., 2101 West Purdue St., Milwaukee 9, Wis.*



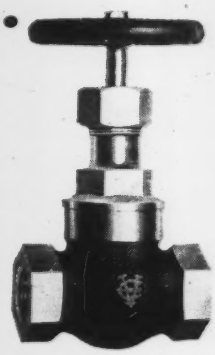
ALL-WELDED STEEL TRAILER—A lightweight, all-welded steel trailer,

No Valve Too Large...



List 35X. These 54" motor-operated Chapman Iron Body Bronze Mounted Gate Valves are shown ready for shipment from the Chapman plant at Indian Orchard.

NO VALVE TOO SMALL...



Bronze Gate Valve for 125 lb. working pressure.

For CHAPMAN to build

Whatever the size valve you need — very large or small, check with Chapman. Valves in the Chapman line range from 9 ft. diameter of opening, to very small iron, bronze or alloy valves.

Consult with Chapman where valves must meet unusual service conditions, and for methods of operation adaptable to your requirements.

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Manufacturing Company
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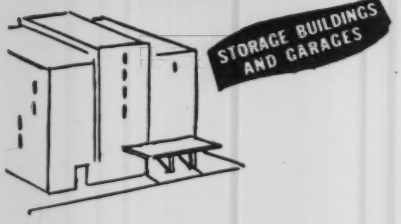
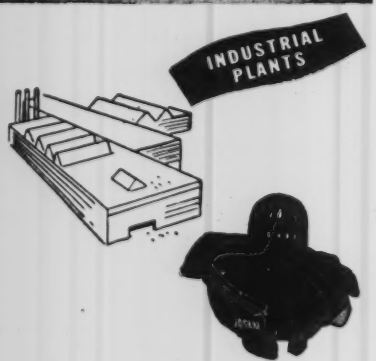
DRAINS FOR EVERY PROJECT ARE MADE BY Josam



Series 0320 Ramp Drain

Series 050 Bridge Drain



Series 490 G. C. Roof Drain

Josam makes hundreds of types of floor, roof, shower drains and other types of drains and drainage products to meet the needs of every type of building. To save time and money, check your drainage requirements with Josam. Send for literature applying to your particular project.

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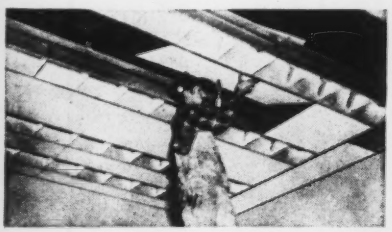
capable of hauling heavy construction equipment while being towed by an ordinary dump truck, is known as the "Tagalong Frontloader Trailer". Welded construction is used to permit maximum joint rigidity while keeping overall weight at a minimum. Trailers are produced with load capacities of 10, 15 and 20 tons. All have a deck length of 14 ft. and a deck width of 8-ft.—*Rogers Brothers Corp., Albion, Pa.*

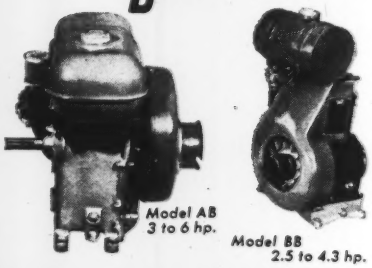


FIBERGLAS ACOUSTICAL BOARD—An acoustical board for use with recessed-type fluorescent light troffers to form a low-cost suspended ceiling with high-sound-absorbing properties is simply laid between continuous troffer rows. Composed of specially processed glass fibers treated with a thermo-setting resin, the board is available in sizes 25½ x 48 in. and 24 x 48 in. Thickness is 1 in. The noncombustible board is beveled and cross-grooved to simulate tile, and is painted white at the factory. The light reflection coefficient is 0.75 to 0.80.—*Owens-Corning Fiberglas Corp., Toledo 1, Ohio.*

CRANKSHAFT—A new type of crankshaft has been developed which is reputed to eliminate air compressor vibration and greatly increase compressor life. Known as the Davey Equi-Balanced crankshaft, the new shaft spreads compressor working strokes evenly over the 360 deg. of crankshaft rotation. In 60 and 105 cfm. V-type compressors, the new design employs a two-throw crankshaft with throws spaced at an angle which is the supplement of the V. In conventional 60 deg., compressor cylinder arrangements, throws are spaced at 120 deg.—*Davey Compressor Co., Kent, Ohio.*

CORRECTION — Incorrect capacity was indicated for the Hystaway machine for Caterpillar tractors on p. 146 of the July 10 issue of *Engineering News Record*. Instead of the 1½ yd. bucket specified for the D7 model, it should have been ½ yd, according to a note from the *Hyster Company, Portland 8, Ore.*

BEE-LINE ENGINES



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These 4-cycle, air-cooled gasoline engines are thoroughly service-proved in many applications. Light weight, compact design, and wide power range mean ready adaptability to many types of equipment and powering problems. Backed by 28 years of engine building experience, including manufacture of the famous Kinner aircraft engines.

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ARE DEPENDABLE
ACTUALLY
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Simply slip the sleeve over the cable, spread the strands, insert and drive in the plug then apply the socket. See what a solid and permanent joint you have by looking at it through the inspection hole put there for the purpose.

By successfully damping vibration, Electroline Fiege Wire Rope Connectors prevent crystallization and wear . . . forestall failure . . . prolong the life of your wire ropes.

But "proof positive" is in their use. Millions are in constant service. Try them. See your mill supply jobber or write to Electroline — manufacturers of this well-known line of time and trouble saving wire rope connectors.

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A Few Choice Territories Still Open for Distributors

Concrete Joist Construction?

Because Today's Costs are NOT Out of Line . . . Because, strength and durability considered, concrete joist construction is the most economical way to build . . .

In these days of high costs, economy in building is important, provided strength and durability are not sacrificed. Here is where concrete joist construction comes in—since it provides rigid, strong, sound-proof buildings which are fire resistive, yet construction cost is lower. That is because the amount of concrete and, consequently, the dead load, are kept to a minimum for any span or live load. The concrete joist and monolithic top slab are formed with cores of removable Meyer steelforms, supported on skeleton centering. Once the concrete has set, the forms are removed and re-used from floor to floor and from job to job. Therefore, a nominal rental charge can be made for each use. Construction is speeded up.

WHY SPECIFY CECO?

Ceco originated the removable steelform method of concrete joist construction. The company is first in the field—actually providing more services than all competitors combined. So, when concrete joist construction fits your need, call on Ceco, the leader over all. Thirty five years of experience in the field, on the job, have given Ceco a sure grasp of all concrete joist construction problems. This fund of knowledge is yours to command, in 23 strategically located offices from coast to coast.

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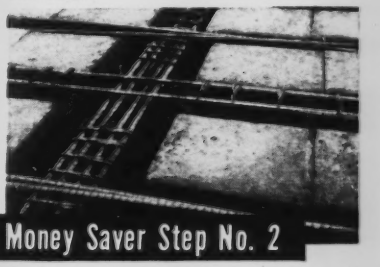
4 STEPS TO REDUCE BUILDING COSTS...

Money Saver Step No. 1

Meyer steelforms completely erected on open wood centering, ready for placement of reinforcing steel and concrete. Note column spirals awaiting installation in columns. Ceco engineers lay out and supervise the complete installation of steelforms on open wood centering.



Money Saver Step No. 2

In this photograph, the reinforcing bars are installed as detailed by Ceco, in proper relation to the erected steelforms. Now the job is ready for placement of the temperature mesh in the top slab. This mesh reinforcement is also supplied by Ceco.

Money Saver Step No. 3

Here the mesh, also known as welded wire fabric, has been placed in correct position and the pouring of concrete for the top slab has commenced. In Ceco-erected jobs such as this, the design is carefully engineered to assure proper reinforcement throughout the structure.

Money Saver Step No. 4

Underneath the concrete joists, Meyer adjustable steel shores support the open wood centering. Forming the floor construction above are adjustable-type steelforms nailed to the centering. Also available are flange-type steelforms, used when plastered ceilings are to be installed.

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MEN AND JOBS

Lt. Col. John W. Miles has been appointed special assistant in charge of all flood control design and construction programs in the Portland, Ore. district, Corps of Engineers, except those in the Willamette Basin. He was transferred to Portland from Mitchel Field, New York, where he was recalled to active duty last November.

C. C. White, formerly district highway superintendent at Pine Bluff, Ark., has succeeded **R. B. Winfrey** as Arkansas state maintenance engineer. **H. M. McMurray** has replaced Mr. White at Pine Bluff.

Earl King, Bethany, Mo., street commissioner, has been appointed county engineer for Harrison County, to replace Orve Isreal, resigned.

Eric Fleming, engineer and architect, has joined the engineering staff of the Public Service Gas and Electric Co., Newark, N. J. For the last three years, Mr. Fleming has been with Voorhees, Walker, Foley, and Smith, New York, handling assignments on special work for the Signal Corps, U. S. Army; on the Standard Oil Research Laboratories, Linden, N. J.; on alterations to the Bank of New York; and on the N. Y. Life Insurance Co. department development at Fresh Meadows, L. I.

Frank I. Vilen, former assistant city engineer of Kenosha, Wis., has been promoted to superintendent of the sewage treatment plant. **Elroy F. Spitzer,** recently in the Civil Engineering Corps of the U. S. Navy has been appointed assistant city engineer.

Lawrence C. Rice recently became chief designer in the sewage treatment department of Gannett, Fleming, Corddry and Carpenter, Inc., Harrisburg, Pa. Mr. Rice, a graduate of the Massachusetts Institute of Technology, worked many years with George W. Fuller and most recently was consulting engineer for Niagara Falls, N. Y., in connection with the operation of the sewage disposal plant there.

C. C. Wilbur recently took over the management of the Gannett, Fleming, Corddry and Carpenter, Inc. office at Scranton, Pa. Mr. Wilbur, a graduate of the Thayer School of Engineering, Dartmouth College, has worked with Hazen & Whipple, consulting engineers of New York and with the City of Minneapolis, Minn. as engineer on the construction of filter plant and pumping station. Later he was consulting engineer on a water softening plant at Minneapolis, and chief engineer of Minneapolis-St. Paul Sanitary District on a $16,000,000 program covering sewage treatment and intercepting sewers.

The retirement of **Simon H. Ingberg,** chief of the fire resistance section of the National Bureau of Standards, has been announced. Mr. Ingberg was born in Norway in 1877. He received his civil engineering degree from the University of Minnesota in 1909 and his master's degree in theoretical and applied mechanics from the University of Illinois in 1910. He joined the bureau staff in 1914 and became chief of the fire resistance section in 1920. For the first ten years of its existence he was the secretary of the Federal Fire Council which is concerned with fire loss prevention for government property.

Eugene Hayes, a former member of the St. Clair County, Ill., board of review, has been appointed general superintendent of construction for the East Side Levee & Sanitary District to succeed William Knaus, who resigned to become superintendent of streets for East St. Louis under Commissioner Alvin G. Fields.

J. H. Hogg, former chief engineer and chairman of the Ontario Hydro-Electric Commission, has been retained as consulting engineer for the Department of Mines and Natural Resources, Province of Manitoba, Can.

George Farrell, colonel in the Missouri state guard during the war, and formerly city engineer at Hannibal, Mo., has been appointed city engineer of Columbia, Mo., replacing Dewey Welch, resigned.

Ralph Tudor, who recently resigned as vice-president of Morrison-Knudsen, Inc., has joined with Clarence E. Seage, consulting engineer, to form Seage and Tudor, with main offices in San Francisco.

Colonel Tudor was graduated from West Point in 1923 and served in the Corps of Engineers until 1929 when he resigned to enter private practice on the west coast. During this period he was senior design engineer of the San Francisco-Oakland bay bridge and later principal bridge engineer for California being responsible for the maintenance and operation of the state's toll bridges, including Golden Gate Bridge. Also during this private practice he supervised construction of California state buildings at the San Francisco

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A BUCYRUS-ERIE dipper, hydraulic or placer dredge is years ahead — built to give efficient, dependable, long-life service on your particular job. It is the result of undivided responsibility — the correlated work of a complete engineering department, an up-to-date manufacturing plant and modern research facilities, all functioning within a single organization. Into the workmanship and design of each Bucyrus-Erie dredge goes this unified knowledge of men devoted to the improvement of excavating methods — knowledge that is broadened by the experience of over 66 years of field-tested service.

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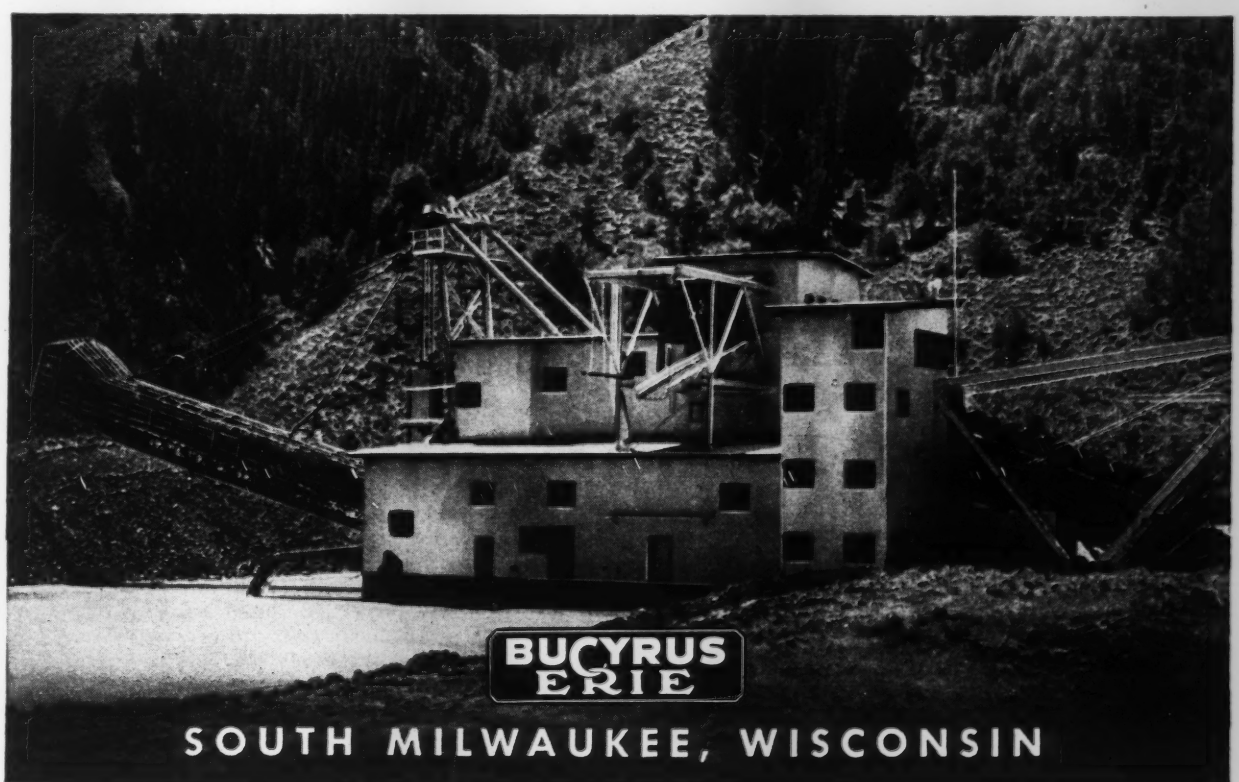

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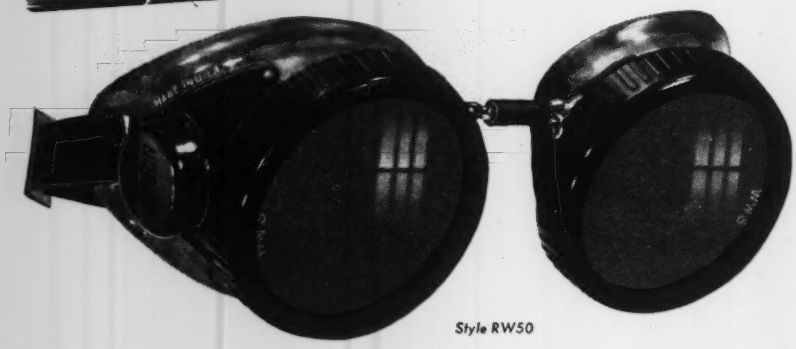
Style CW60

ROOM WANTED FOR SPECTACLES? . . . There's comfort for wearers of prescription glasses in Willson Cover-Alls.* And the adjustable leather bridge rests lightly on the nose without pressure. Willson-Weld* lenses in the shade you specify, of course.



Style RW50

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Exposition. He was recalled to active service by the Army in 1941 and assigned to the Portland, Ore., office as head of the engineering division. In 1943 he was made district engineer and Bonneville Dam was completed under his supervision. Released again by the Corps in December, 1945, he joined Morrison-Knudsen the next month. From that time until his recent resignation he has been chief engineer of the work in China, where M-K International made a survey and report on that country's railroad and harbor system.

James Stober, Allison, Iowa, has been appointed Chickasaw County engineer with headquarters at New Hampton to succeed S. M. Helgeland, resigned.

John Daley has been appointed city engineer and superintendent of maintenance at Cut Bank, Mo. He succeeds both F. A. Daley, city engineer and John Monroe, maintenance superintendent.

John Grund recently resigned as city engineer at Evereth, Minn., and has moved to Fairmont, to join the city engineering staff.

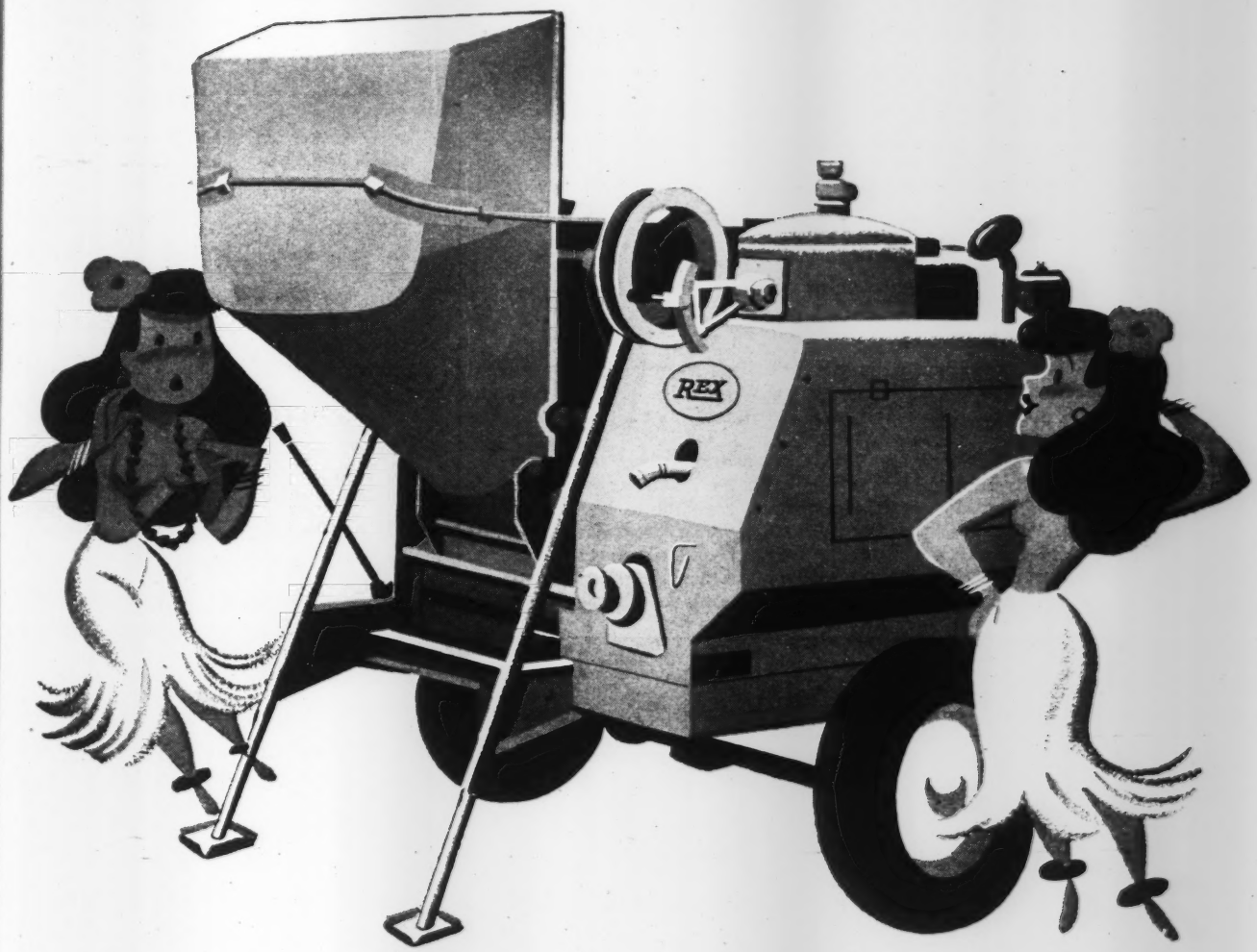
J. M. Odom, Austin, Texas contractor and engineer, has been appointed a member of the new Texas Plumbing Board, succeeding **Warren Bellows** of Houston, who resigned.

Gen. Carl R. Gray, Jr., vice-president of the Chicago & Northwestern Railway System, has been appointed special advisor and consultant on the rehabilitation of the Alaska Railroad by Secretary of the Interior J. A. Krug.

Laurice A. Weinstein and **O. W. Clayton** of Charlotte, N.C., have formed the Queen City Engineering Co., a contracting and engineering business.

Gerald C. Cooper of Mound City, Kan., has been appointed county engineer for Bourbon County at Fort Scott. Cooper succeeds **Grover C. Thompson,** who resigned to join the Bureau of Reclamation at Casper, Wyo. For the last 12 years, Cooper has been employed on highway engineering jobs by Linn County.

William B. Boucher, Lincoln, Neb. succeeds the late Roy M. Young, as district airport engineer, for Nebraska and South Dakota CAA. His offices will be in Lincoln. He has been serving as chief of engineering and construction, air branch, CAA, at Kansas City, Mo. Until a successor is named for the Kansas City post, he will divide his time between the two cities.



"Wish we could 'shimmy' like that Rex Skip"

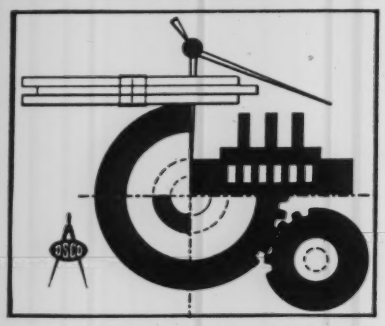
The Rex "Shimmy Skip" is in a class by itself when it comes to getting the batch into the drum faster! You don't have to pound it to get all the batch to drop. The "Shimmy Skip" provides just the right amount of snappy, shaking action . . . 304 sharp impacts per minute . . . for a clean, quick, time-saving charge that adds up to more batches per day . . . more yards per job . . . more profit for you.

The Rex "Shimmy Skip" is actuated by wedge-shaped lugs on the drum . . . the heaviest part of the mixer. As the drum rotates, these lugs engage shaker rollers on the skip, causing the "shimmying" action. There are no cams, gears, delicate adjustments, or fast wearing parts. There is no strain or extra wear on the skip . . . no extra burden on the transmission. Skip itself is sturdily built of heavy-gauge steel for maximum service life.

For all the facts, see your Rex Distributor or write for a copy of Bulletin No. 480. Chain Belt Company, 1633 W. Bruce St., Milwaukee 4, Wis.

CHAIN BELT COMPANY of *MILWAUKEE*

CONSTRUCTION MACHINERY



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Elections and Activities

Lieut. Comdr. Paul F. Ferrero, Chevy Chase, Md., has been elected president of the Civil Engineer Reserve Association in Washington, D.C. Comdr. Paul C. Gillette, CEC, USNR, officer in charge announced other officers elected. These are Lieut. Stanley C. Orr, Hyattsville, Md. vice-president; Lieut. Hugh E. Hegarty, Alexandria, Md., secretary-treasurer.

Charles Larsen, Lakeland city manager ,was elected president of the newly formed Florida State Society of Professional Engineers. Other officers chosen were Stephen A. Derry of Gainesville, vice president and William E. Godfrey, Lakeland, secretary.

A committee has been named to plan a South Carolina Society of Professional Engineers. A. C. Crouch is secretary, and Dean S. B. Earle of Clemson College is chairman.

At a recent meeting at Red Lake Falls, Minn., the ninth district Chapter of the Minnesota Association of Professional Engineers was organized. which will take in the northwestern section of the state. M. C. Peterson, Bemidji, engineer with the Minnesota State Board of Health, was elected president; Harry Paine, Bemidji, Beltrami County highway engineer, was elected secretary.

Officers for the Central Section of the Illinois Water Plant Operators, elected recently were: Frank Turner, chief operator, Paris, president; Henry Wagner, operator, Illinois Water Service Co., Pontiac, secretary.

The Florida Committee on Water Supply and Sewerage Education has been formed for a continuous training program for water and sewage plant operators of Florida. To meet this need, sponsoring organizations, including the University of Florida, established a Committee charged with the responsibility of developing not only the annual short course and conference but also other methods of making training available to operators throughout the year. Persons appointed to serve on this committee are: David B. Lee, chief sanitary Engineer, Florida State Board of Health, Jacksonville, Chairman; A. P. Black, College of Arts and Sciences, University of Florida, Gainesville; J. R. Hoy, Secretary-Treasurer,

1+1=3

1 JAW CRUSHER
1 TWINDUAL* ROLL CRUSHER
3 STAGES OF REDUCTION

THE AMAZING NEW UNIVERSAL TWINDUAL* MASTER

Here's the first really new and advanced post-war gravel plant. Size for size and weight for weight the TWINDUAL* MASTER has no equal for production. Under identical pit conditions it has out-produced larger, conventional model plants by 50 to 100%. TWINDUAL* Rolls give two stages of secondary reduction and provide amazing capacity with savings in weight and power. Permits 100% wider primary discharge opening, doubling jaw crusher capacity and reducing jaw wear. For the first time, 3 full stages of reduction in a complete single-unit gravel plant. *First* stage—JAW CRUSHER; *second* and *third* stages—**TWINDUAL* ROLLS. Universal "Stream-Flo" Engineering again sets the standard for profit-making production and ready portability. For TOP CAPACITY at lowest cost per yard investigate the new TWINDUAL* MASTER.

WRITE FOR BULLETIN No. 682

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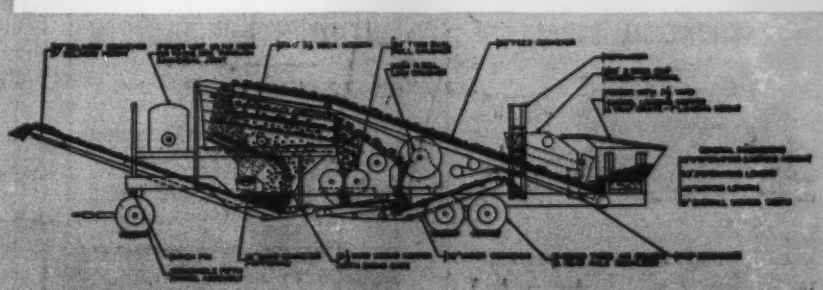
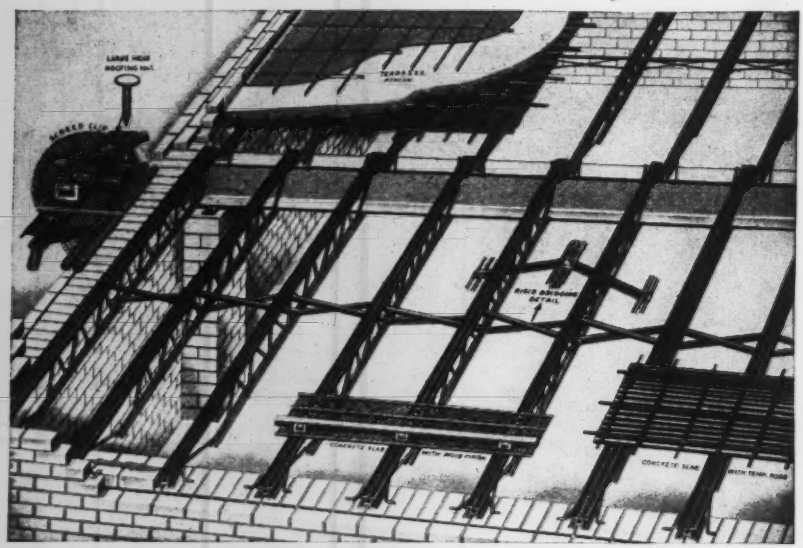
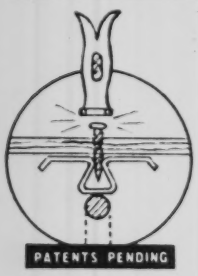


MACOMBER
V TYPE
BAR JOISTS





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Sizes 1" to 12"

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Florida Sewage Works Association, Jacksonville; Harry T. Oberly, Chairman, Florida Section, American Water Works Association, St. Petersburg; Thomas Paul, Florida Water and Sewage Works Operators Association, Bradenton; G. M. Turner, General Extension Division, University of Florida, Gainesville; Clifford D. Williams, College of Engineering, University of Florida.

Plans for the national convention of the Society of Professional Engineers, to be held in Buffalo, N. Y., next December, were outlined recently at the annual outing of the Erie County Chapter of the New York State Society of Professional Engineers. John Johnson, president of the local chapter, was chairman. Guests included representatives of chapters from Niagara Falls, Rochester, Jamestown, Albion; William H. Larkin, president of the state society, and George H. Barrows, executive secretary.

H. C. Nicholls, of Toronto, Ont., has been re-elected president of the National Construction Council of Canada. Other officers also re-elected are: first vice-president, G. M. Thomson; second vice-president, Ernest Ingles; treasurer, L. L. Anthes; secretary, I. Markus. Mr. Nicholls is of Milne and Nicholls, General Contractors, Toronto.

John W. Hager was elected president of the Birmingham, Ala., Engineers Club at a recent meeting. Other officers are: Joe R. Hill, vice president; C. P. Shook, Jr., secretary-treasurer; Mrs. Lucile M. Cunniff, executive secretary; J. E. Getzen, Ralph M. McIntyre, F. B. Neilson and Sprigg C. Ebbert, directors.

E. K. Van Winkle, Atlanta, heads the Georgia branch of the Associated General Contractors of America. Mr. Van Winkle, who is connected with Van Winkle and Co. succeeds P. D. Richardson Jr., of Christian & Bell Co. The latter automatically became a member of the board of directors. Other officers are Ira H. Hardin, first vice-president; Merrill W. Newbanks, second vice-president; J. J. Black, treasurer, and A. J. Collins, treasurer.

Ohio Ready Mixed Concrete Association has elected Ralph H. Anderson, of W. E. Anderson & Son, Columbus, as president, with R. P. Mumford, of Beckley & Myers Co., Springfield, vice president; Claude L. Clark, 63 S. High St., Columbus, secretary; and S. Stepanian, Arrow Sand and Gravel Co., Columbus, treasurer. Named directors for three-year terms were John D. Kling, Cleveland; John D. Hall, East Liverpool; and M. Paul Hunt, Marion.

NOW...NO WATER SUPPLY JOB TOO SMALL... OR TOO LARGE!

With the establishment of its new permanent pressure pipe plant in Wharton, N. J., Lock Joint Pipe Company is now able to supply pressure pipe in any desired quantity and in a larger range of diameters than heretofore.

The Wharton Plant, specializing in Lock Joint Prestressed Concrete Cylinder Pipe, is equipped to produce pressure pipe in all standard diameters from 16" up, and for all pressures common to American water works practice.

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Prompt delivery can be effected by truck for short hauls direct to the installation site, or by rail to more distant localities.

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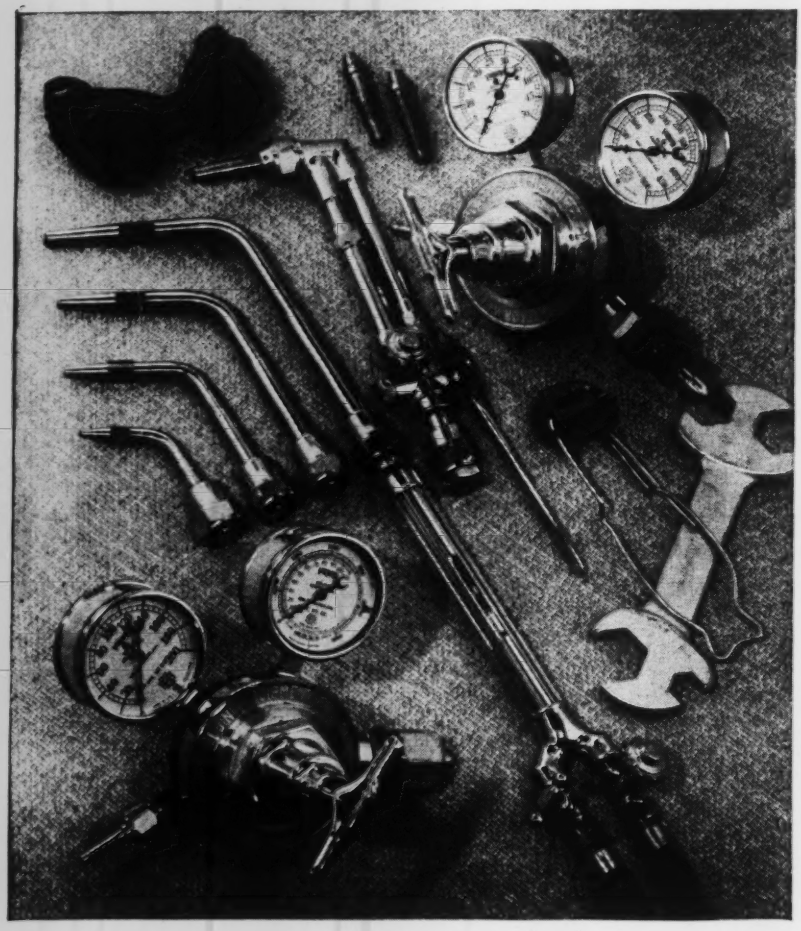
LOADING PIPE IN RAILROAD CARS AT WHARTON PLANT

here is beauty

that is more than skin deep



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on the construction job, particularly, a good gas welding and flame cutting outfit is a necessity. on a construction job, however, such an outfit is used largely for emergency repair, for hard facing, for silver brazing and for flame cutting—such an outfit, therefore, must be dependable . . . on the job when needed. and—that quality is one of the numerous reasons why victor welding and cutting equipment is today the most popular and one of the most highly regarded in industry.

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Manufacturers' Activities

Appointment of C. J. FOURNIER as manager of the Ford Motor Company's parts and service department for the Southwestern region has been announced.

To provide the best possible service to owners of their products, the DETROIT DIESEL ENGINE DIVISION, General Motors Corp., has set up at its factory in Detroit a completely equipped school for training GM Diesel mechanics in the operation and servicing of the Series 71 engine. Detroit Diesel distributors and dealers may, upon proper application, send their service personnel to the factory for a concentrated but thorough training course in basic Diesel mechanics.

Appointment of W. T. MCCURDY as district manager for the states of Tennessee and Arkansas is announced by Mack Trucks, Inc. He will supervise all of Mack's activities in these two states, including a dealer organization composed of twenty-one outlets. His direct sales efforts will be focused particularly on off-highway trucks and fire apparatus.

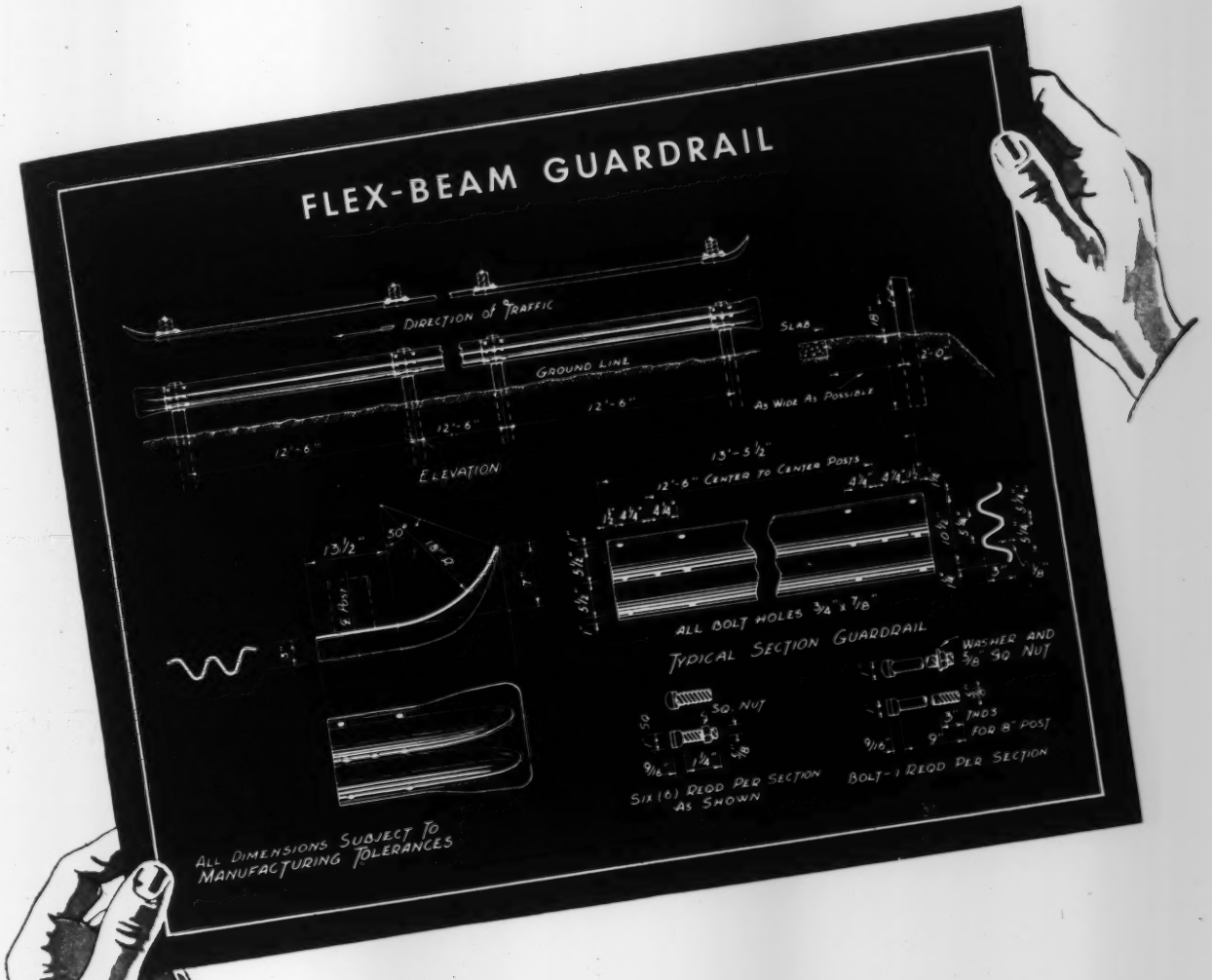
THE TRANE COMPANY, La Crosse, Wis. manufacturers of heating, cooling and air conditioning equipment, announce the appointment of Ralph E. Lee as manager of the unit heater sales department. Mr. A. H. Kaulfuss has been named assistant manager.

J. LESTER PERRY, assistant to Benjamin F. Fairless, president of the United States Steel Corp. of Delaware, has been elected president of Columbia Steel Co., U. S. Steel's West Coast subsidiary, succeeding the late William A. Ross.

L. L. LAWRENCE has been appointed manager of the Gardner-Denver Co. branch office in Boston.

Production capacity of the Middle Branch, Ohio, mill of DIAMOND PORTLAND CEMENT CO. will be increased 50 percent by the erection of a cement kiln by The Rust Engineering Co., Pittsburgh, Pa., under a contract recently announced.

The RustaRestor division of the JOHNSTON & JENNINGS CO., Cleveland,



blueprint for safety

We put this safety specification on paper to show you why it works so well in actual practice.

Every detail of FLEX-BEAM Guardrail is designed for utmost safety. No wonder it promotes driver confidence, encourages safer driving, and guards against injury and loss of life.

This sturdy rail is made from heavy-gage steel for toughness and resiliency. Extra deep corrugations lend it unsurpassed beam strength while heat-treated bolts assure positive splices. With FLEX-BEAM, all the strength is in the rail. There is no dangerous pocketing, and the continuous sliding surface automatically deflects a striking vehicle and guides it parallel with the road.

Unskilled workmen easily install FLEX-BEAM with ordinary hand tools. No adjustments are needed. No springs, turnbuckles, deadmen or castings. Any type post may be used. No stretching is necessary on curves and the posts stay in perfect alignment. And maintenance is sure to be low because an occasional easy painting job is usually all that's required.

A small investment will prove to you that FLEX-BEAM is the simple, practical way to lessen certain traffic hazards. Write for complete information and ask about FLEX-BEAM Bridge Rail as well. Armco Drainage & Metal Products, Inc., 365 Curtis Street, Middletown, Ohio. Sheffield Steel Corp., Kansas City, Missouri.

Flex-Beam
GUARDRAIL
ARMCO

Steel forms BY Heltzel

★

CONCENTRATED *Engineering* IN CONCRETE CONSTRUCTION

★

HEAVY-DUTY HIGHWAY AND AIRPORT FORMS The 7/32" form is recommended for all concrete slab construction up to 20' widths. The 1/4" form is recommended for slab widths over 20' widths.

HELTZEL LIP CURB FORMS Quickly and easily affixed to the road form by means of two swivel clamps.

HELTZEL HEADER FORMS Quickly and easily assembled by engaging the hook bolt beneath the flange on the tread of the road form.

HELTZEL INTEGRAL CURB FORMS A positive rigid form assembly for building curbs integrally with the road slab.

HEAVY-DUTY ROUND STAKE PULLERS Pay for themselves on any job by providing a method for quickly and easily withdrawing stakes.

HELTZEL STEEL CURB-and-GUTTER FORMS Sections are 10' long and two supports are furnished for each section.

RIGID RADIUS OR FLEXIBLE STEEL FORMS Available to match any specification.

HELTZEL HEAVY-DUTY DOWEL JOINT CURB FORMS These forms furnished in any height and to match any cross section.

Heltzel Steel Form & Iron Company, Warren, Ohio

SEND ME STEEL FORM CATALOGS

[ ] B-19 Steel Highway and Airport Forms

[ ] B-19A Steel Dual Duty Airport Forms

[ ] A-20 Steel Forms for Curbs or Curb and Gutters or Sidewalks.

Name_____

Address_____

_____

(Type of construction usually engaged in)

Heltzel — CURBS IN CONTROL

- BINS, Portable and Stationary
- CEMENT BINS, Portable and Stationary
- CENTRAL MIXING PLANTS
- BATCHERS (for batch trucks or truck mixers with automatic dial or beam scale)
- BITUMINOUS PAVING FORMS
- ROAD FORMS (with lip curb and integral curb attachments)
- CURB FORMS
- CURB AND GUTTER FORMS
- SIDEWALK FORMS
- SEWER AND TUNNEL FORMS
- CONCRETE BUCKETS
- SUBGRADE TESTERS
- SUBGRADE PLANERS
- TOOL BOXES
- FINISHING TOOLS FOR CONCRETE ROADS

HELTZEL STEEL FORM & IRON CO. WARREN, OHIO · U. S. A.

Ohio, manufacturers and installers of cathodic equipment to prevent steel tanks from rusting, announces the appointment of George L. Fox as sales manager.

The appointment of WALLACE H. HUNTER as senior contracting manager of the Chicago district was announced today by the American Bridge Co., U. S. Steel subsidiary. Mr. Hunter will be in charge of all contracting work of the company in the Chicago district, including the contracting sub-office at Gary, Ind. Newton O. Holt will continue as contracting manager, Chicago district.

H. N. HOW, president of the Western Machinery Co., announces the opening of the firm's new Chicago sales office. The Chicago office also offers the complete services of Western-Knapp Engineering Co., a division of Western Machinery Co.

A new service branch has been established at Charlotte, N.C. for the convenience of users of BLACK & DECKER and VAN DORN portable electric tools. This is an addition to the 22 Black & Decker factory service branches at strategic points throughout the country.

DOUGLAS M. LYON has been made sales manager of the Porter-Cable Machine Co., Syracuse, N.Y., succeeding H. L. Ramsay, who has been made vice president in charge of merchandising.

The growing demand of Illinois industry, particularly in Macon County, was the reason for the opening of the new AIR REDUCTION oxygen plant there recently. The new plant will supply oxygen to points formerly serviced by Air Reduction plants in St. Louis and Chicago. Another oxygen manufacturing plant was added at Baton Rouge, La., according to a recent announcement made by L. A. Bruno, Airco's district manager.

WILLIAM A. ROBERTS and WILLIAM C. JOHNSON have been appointed executive vice-presidents, respectivly, of the tractor and general machinery divisions of the Allis-Chalmers Manufacturing Co. Two new vice-presidents for the two divisions of the company have also been appointed. They are Marshal L. Noel, vice-president and general sales manager for the tractor division, and J. L. Singleton, vice-president and director of sales for the general machinery division.

SIOUX MACHINERY & SUPPLY CO., 315 West 7th St., Sioux City 17, Iowa, has been appointed as an authorized distrib-

Powered to Build Better Profits . . .

ADVANCE-DESIGN CHEVROLET TRUCKS

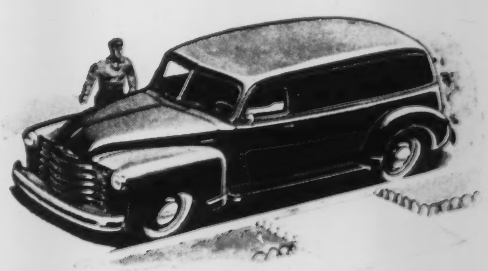
WITH THE CAB THAT "BREATHES"

America's first ADVANCE-DESIGN trucks, featuring the larger, roomier cab that "breathes"! The unique new cab almost literally "inhales" fresh air and "exhales" used air,* assuring day-long driver comfort and efficiency. Other new features and innovations make these the trucks to see *first* at your Chevrolet dealer's!

Extra-economical and powerful Chevrolet **VALVE-IN-HEAD ENGINES** are time-savers, profit-makers! There are exclusively designed **HYDRAULIC TRUCK BRAKES,** too, with greater brake-lining contact for quick, safe stops!

More efficient loading in stake and high rack bodies—more **LOAD SPACE** in panels and pick-ups. Chevrolet truck **FRAMES** are new, stronger and sturdier, designed to carry greater loads for a longer time!

Better load distribution, due to **LONGER WHEELBASES. FULL-FLOATING HYPOID REAR AXLES** mean extra pulling power! They're geared for the load!



**Fresh-air heating and ventilating system optional at extra cost.*

CHEVROLET

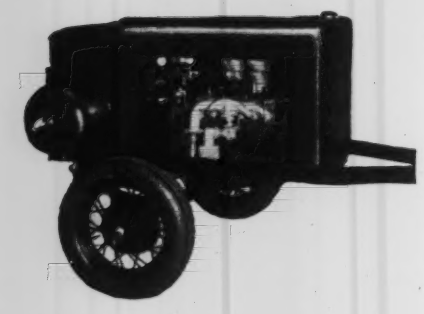
CHEVROLET TRUCKS

FOR TRANSPORTATION UNLIMITED

Pick-ups Panels Stakes Cab-Over-Engine Tractor-Trucks & Chassis for Special Equipment

CHEVROLET MOTOR DIVISION, *General Motors Corporation,* DETROIT 2, MICHIGAN

Your Chevrolet dealer can supply standard or special equipment for your specific hauling needs.



Turn on the

POWER

The
Smith Air Compressor
delivers ample power
for most compressor
jobs--at less cost!

READY POWER..portable..economical power, is yours with a lightweight Smith Air Compressor. Big enough to operate medium weight rock drills, paving breakers, clay spades, tampers, large spray guns. Small enough to be towed at truck speeds from job to job. Capacity 60 cu. ft.

Its Ford Motor and standard parts insure ready servicing anywhere. Uses only 1 gal. of gasoline an hour. Automatic unloading and idling. No couplings, belts or gears.

Let a Smith Air Compressor simplify your compressor work. Write, phone or wire for complete facts.

GORDON Smith & CO. Incorporated

430 College St. Bowling Green, Ky.

utor for Carboloy Company, Inc., of Detroit, Michigan. It has handled cutting tools, abrasives, welding equipment, construction equipment and general industrial supplies since 1944.

GEORGE H. WOODARD, formerly connected with the Westinghouse Electric Corp. has entered consulting practice in affiliation with Charles H. Welling & Co., Inc., 52 Vanderbilt Ave., New York City. He will serve manufacturers interested in development of new product lines.

UNITED STATES PLYWOOD CORP. has purchased the G. A. Mason Door Co. of Milwaukee, Wisc., and will continue the firm as a branch warehouse. The Mason company is a distributor of doors and other building specialties. Glenn A. Mason will continue as the manager of the Milwaukee branch office.

A two-year modernization and expansion program will find SKF INDUSTRIES, INC., spending more than $4,000,000 to equip its two Philadelphia plants with new machinery capable in some instances of operating from two to six times faster than standardized equipment long used in the anti-friction bearing industry. While the bulk of the expenditures will go for new machinery required in the production of anti-friction bearings, the program is aimed primarily at stepping up production of spherical roller bearings.

Dissolution of Plant Rubber & Asbestos Works as a separate corporation has been announced. It will continue to operate without change of officers, policy, or organizational personnel, as the PLANT RUBBER & ASBESTOS WORKS, a Division of The Paraffine Companies, Inc.

At a recent meeting of the directors of THE CELOTEX CORP. Fergus A. Irvine was elected vice president in charge of production. The functions of purchasing and traffic have been combined under a newly created office of director of purchases and traffic, to which office James W. Franklin has been named. P. D. Walsh continues as general traffic manager and Harry B. Cleveland has been appointed general purchasing agent. Richard H. Thompson has been appointed assistant to the president.

A ground breaking ceremony took place at ARMCO's east works, Middletown, Ohio, recently, signalling the beginning of construction of two huge electric furnaces. Using the same historic silver spade which broke ground for the plant 37 years ago, an Armco official inaugurated the $3,000,000 construction project in a formal ceremony. The furnaces will be of the latest design, with rated steel-making capacities of 70 tons each. Construction is expected to be completed early next year.

THE HEIL CO., Milwaukee, Wis., announces the appointment of Walter "Mike" Carlson as assistant sales manager of its truck body and hoist division.

DAYTON F. RIVAS has returned to the Jaeger-Lembo Machine Corp., of New York, after four years with the U. S. Air Forces, with which he served for 2½ years as a fighter pilot overseas. He will represent the company in Dutchess, Putnam, Orange, Rockland and Sullivan counties.

Announcement has been made of the formation of RAILROAD SIDING CONSTRUCTION CO., P. O. Box 694, Pittsburgh, Pa. Besides handling new sidings, the company will take contracts for maintenance and rehabilitation of old sidings and can also handle excavations in conjunction with any siding work. Work at present is being limited to Pennsylvania, Ohio, Indiana, New York, Delaware, Maryland and West Virginia.

WILLIAM D. SPEARS, prominent Chattanooga attorney, has been elected president of the Cumberland Cement Co. succeeding Frank Pearson, who has retired from the presidency after 21 years as officer and one of the founders of the company.

LINK-BELT CO., Chicago, Ill. announces that Harold L. Hoefman was elected vice-president, in charge of manufacturing. David E. Davidson has been appointed general manager of the Pershing Road plant.

CHAMPION MANUFACTURING CO., manufacturers of masonry cutting saws and masonry cutting blades have moved into larger, more modern quarters at 2028 Washington Ave., St. Louis, Mo. New quarters consolidate under one roof the general offices, fabricating and assembly departments, product research and engineering and warehousing.

Brig. Gen. HUGH C. MINTON, who was named production manager of Koppers Company, Inc., on May 10, has been made a vice president of the company.

Appointment of JOHN R. JOHNSTON as assistant general sales manager, Carnegie-Illinois Steel Corp., has been announced. He will be succeeded as sales manager in the Milwaukee district office by Charles E. McIntyre, who was formerly assistant manager of the Detroit district sales office.

BEST BET FOR *Heavy Hauling*

GMC TRUCKS

GASOLINE · DIESEL

If you are interested in getting maximum performance at minimum operating and upkeep cost, it will pay you to investigate the new GMC heavy duty truck line. GMC builds heavy duty trucks specifically designed to fill the vast majority of heavy hauling requirements. More than that, GMC offers you the kind of powerplant . . . gasoline or Diesel . . . best suited to your job.

GMC's four heavy duty gasoline and two heavy duty Diesel engines comprise one of the widest choices of powerplants made available by any manufacturer in the truck industry. Combined with GMC's extensive range of chassis types, axle, transmission and equipment options, they permit selection of heavy hauling equipment that is exactly suited to a specific operation . . . and that is "tailor-made" to perform it at the highest peak of efficiency and economy.

If you are not getting the kind of results you should be getting from your present heavy duty trucks, consult your GMC dealer. He's a truck expert. He'll advise you . . . without prejudice . . . on the kind of power that will give you the best performance on your particular operation. For he sells and stands back of both types of GMC heavy duty power . . . Diesel and gasoline.

GMC TRUCK & COACH DIVISION • GENERAL MOTORS CORPORATION

Excellent FOR BOTH THICK AND THIN CONCRETE SECTIONS

This husky, self-contained, trouble-free unit, powered by a thoroughly dependable Wisconsin engine with automatic clutch, may be had with three vibrator heads for thick and thin sections, flexible shafting (½" core) in 7 to 14' lengths up to 28 ft. Full swivel, dirt-proof base. Variable speed control up to 7500 V.P.M. Wheelbarrow with drop handles is optional.

The JACKSON line contains the ideal vibrator (internal or external, hydraulic, flexible shaft engine or electric motor driven) for every type of concrete construction. Write for information on the type you are interested in.

ELECTRIC TAMPER & EQUIPMENT CO.
LUDINGTON MICHIGAN

...SPEED
CONSTRUCTION
with CLIPPER
PORTABLE HOISTS
UNLOADS AUTOMATICALLY
2 to 1 RATIO
One-Man operation . . . Clamps to Scaffold. Ideal for Brick, Tile, Blocks, Mortar and many other construction items.
$54.45
You can have Clipper Hoists on FREE TRIAL Write for Literature!
Brick Clamps $4.95 ea.
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2800 WARWICK • KANSAS CITY 8, MO.
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CLIPPER PORTABLE HOISTS
by the Makers of
CLIPPER MASONRY SAWS

Manufacturers' Publications

Reflective Roof Coating—(Illustrated folder) Describes Gilsalume, insulating paint designed to provide low-cost roof protection and year-round weatherproofing. — *United Gilsonite Laboratories, Scranton 1, Pa.*

Air Compressor Lubrication—(40-p. booklet) Gives helpful information on care and preventative maintenance lubrication of various types of compressors and their auxiliary equipment.—*Petroleum Advisers, Inc., 60 Wall Tower, New York 5, N. Y.*

Asphalt—(12-p. booklet) Describes and gives advantages of Permacote for roads. It is profusely illustrated with charts and graphs.—*Berry Asphalt Co., 120 S. LaSalle St., Chicago 3, Ill.*

Lubricating Systems—(8-p. booklet) Gives representative case histories of use of centralized lubrication on industrial equipment, demonstrating its economies and efficiency. — *Farval Corp., 3249 E. 80th St., Cleveland 4, Ohio.*

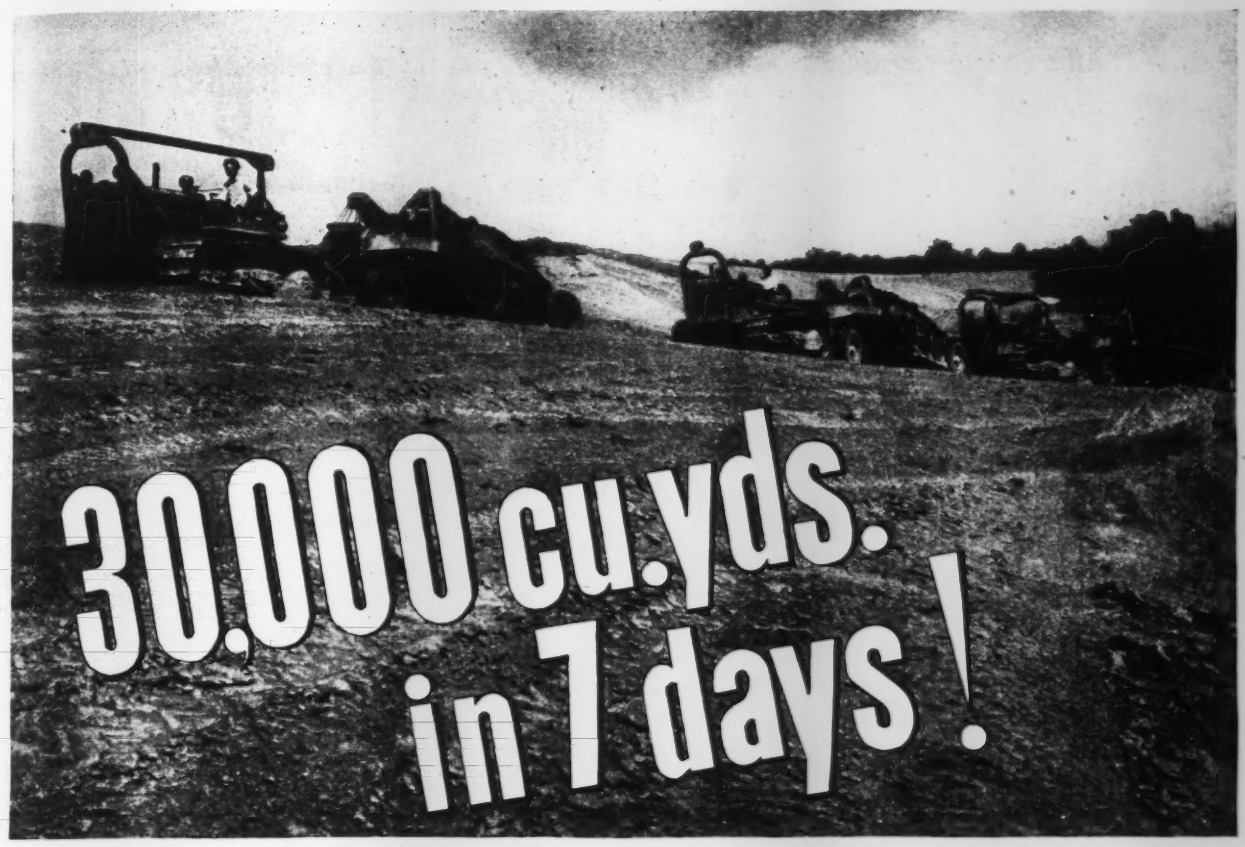
Road Maintenance Kettle—(Illustrated folder) Describes 84-HD Kettle, as well as Model No. 101 utility spray tank, motorized portable Trail-o-Roller, and emulsion sprayers. — *Littleford Bros., Inc., 457 E. Pearl St., Cincinnati 2, Ohio.*

Blowers—(8-p. booklet) Shows numerous rotary positive and centrifugal installations of blowers in typical sewage disposal plants. — *Roots-Connersville Blower Corp., 900 W. Mount St., Connersville, Ind.*

Protective Coatings—(4-p. catalog) Lists features of Prufcoat and chemical agents it resists, as well as uses and complete application information.—*Prufcoat Laboratories, Inc., 63 Main St., Cambridge 42, Mass.*

Drive Selection—(144-p. catalog) Covers pre-engineered Texrope drives for all applications from 1 to 150 hp. It is said to represent one of most complete compilations of engineering data ever assembled for the V-belt industry. —*Allis-Chalmers Mfg. Co., Milwaukee, Wis.*

Dragline and Crane—(12-p. bulletin) Describes new 1¼-cu. yd. Type 71 with air control and air-cushion



...the fast, bonus loading—the fast, clean dumping — the dependability of 3 HEIL Cable Scrapers save time and money on Mississippi River levee job!

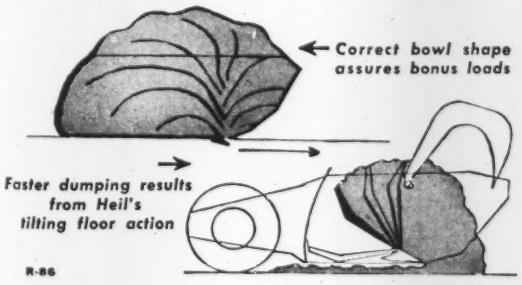
Heil Cable Scrapers have a reputation for moving more dirt, faster and at lower cost. They earned this reputation the hard way, on just such jobs as this Mississippi River levee. Only three Heil Cable Scrapers were required — two eight- and one ten-cu. yd. units — to move 30,000 yds. of heavy gumbo in one week's time. This is earth-moving at its best — made possible by the following Heil features:

Greater digging ability — Heil Cable Scrapers load in a shorter distance because they dig harder. The draft pivot point is located in such a way that the weight of the scraper is placed on the cutting bit for better penetration.

Bonus loads, no voids or waste — the shape of the bowl and front gate of Heil Cable Scrapers conforms to the boiling action of the dirt as it is dug. There are no empty pockets to fill, so the scraper loads to capacity quickly — no material is thrown over the back of the bowl; no wasted effort or lost time.

Faster, cleaner dumping — the high-opening front apron permits a third of the load to roll out by gravity. The remainder is ejected by means of a tilting floor. Both the sides and rear of the bowl are scraped clean during this tilting operation. The efficient Heil dumping action requires little line pull — loads can be dumped at hauling speeds — no time is lost in shifting gears.

Prepare for the busy days and the tough competition ahead. Use time- and money-saving Heil Cable Scrapers to do your earthmoving — they are available in all the standard sizes. See your International Industrial Power distributor for all the facts. Write for latest bulletins.



THE HEIL CO.

GENERAL OFFICES • MILWAUKEE 1, WISCONSIN

COMPARE A

ONE CU. YD. CARRYING CAPACITY

Page Automatic

WITH YOUR PRESENT DRAGLINE BUCKET!

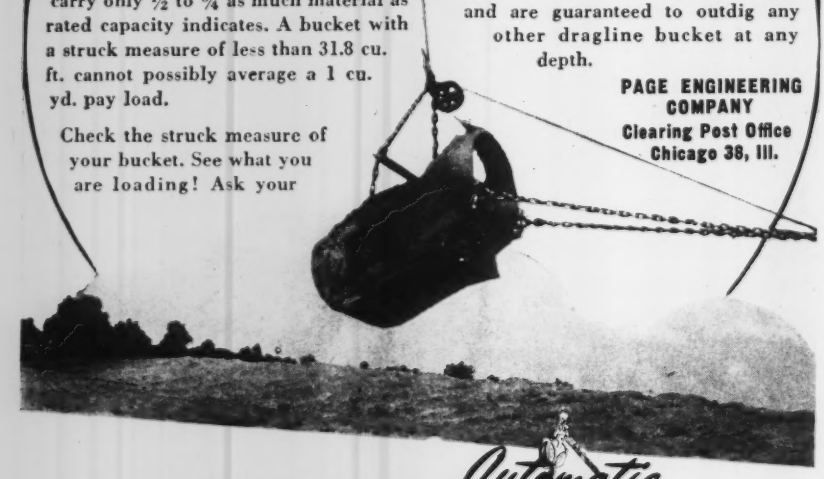
ONE CU. YD. RATED CAPACITY

The Page AUTOMATIC is built large enough to make the carrying capacity *equal* to the rated capacity size. A 1 cu. yd. Page bucket will load and carry 1 cu. yd. of material. Ordinary buckets do not have sufficient allowance for the curved portions and the open end and, therefore, carry only ½ to ¾ as much material as rated capacity indicates. A bucket with a struck measure of less than 31.8 cu. ft. cannot possibly average a 1 cu. yd. pay load.

Check the struck measure of your bucket. See what you are loading! Ask your dealer. Write for new booklet "How to Get the Most Out of a Page AUTOMATIC Dragline Bucket." It lists minimum struck measurements for all size buckets giving *true* ratings.

Page AUTOMATICS are built in perforated, slat or standard designs and are guaranteed to outdig any other dragline bucket at any depth.

PAGE ENGINEERING COMPANY
Clearing Post Office
Chicago 38, Ill.



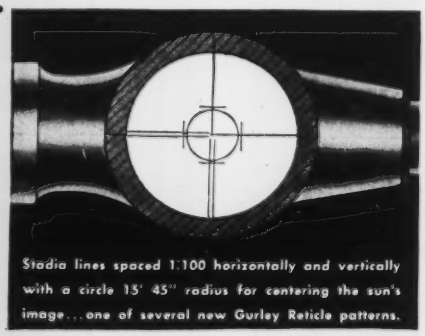
PAGE Automatic

DRAGLINE BUCKETS and WALKING DRAGLINES

• The New Gurley
• Transit Reticle
• for More Accurate Pointing
• Triangulation
• Stellar Observation

Short stadia lines, spaced and ruled at precise intervals on optically flat glass, are easy to sight...do not extend over entire field of view nor interfere with cross-lines. Send for Bulletin No. 50. W. & L. E. Gurley, Union Plaza, Troy, New York.

Available only in Gurley Instruments



Stadia lines spaced 1:100 horizontally and vertically with a circle 15' 45" radius for centering the sun's image...one of several new Gurley Reticle patterns.

GURLEY

Surveying & Scientific Instrument Makers Since 1845

clutches. It is available as both crawler and wheel-mounted machine.—*Osgood Co., Marion, Ohio.*

Diesel Tractors—(Two folders) Describe power and work features of diesel D6 and D4 tractors.—*Caterpillar Tractor Co., Peoria 8, Ill.*

Rehandling Buckets—(8-p. bulletin) Describes E-16 rehandling clamshell bucket and economies it makes possible. It shows how bucket can be adapted for excavating, mud work, dredging and other services. Chart lists bucket load capacities, weights and dimensions in terms of various materials handled, together with figures on recommended wire rope diameters, reeving and closing lengths.—*Hayward Co., 50 Church St., New York 7, N. Y.*

Acetylene Generator—(22-p. catalog) Lists and explains complete line of Airco acetylene generators, both stationary and portable, outlining advantages of each. It also covers Airco manifolds for oxygen and acetylene.—*Air Reduction Sales Co., 60 E. 42nd St., New York 17, N. Y.*

Portable Compressors—(4-p. bulletin) Includes photos and detailed mechanical specifications of 60-105-160-210-315 c.f.m. capacity machines.—*Davey Compressor Co., Kent, Ohio.*

Lubrication Problems in Strip Mining—(Illustrated booklet) Describes use of specifically recommended lubricants in earthmoving equipment. Panoramic and closeup photographs show this equipment at Pennsylvania strip mines where Swan-Finch oils are used.—*Swan-Finch Oil Corp., R. C. A. Building West, New York 17, N. Y.*

Rotary Dumpers—(20-p. book) Covers various types of mine car dumpers, car feeder haulage, and railroad car dumpers.—*Link-Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.*

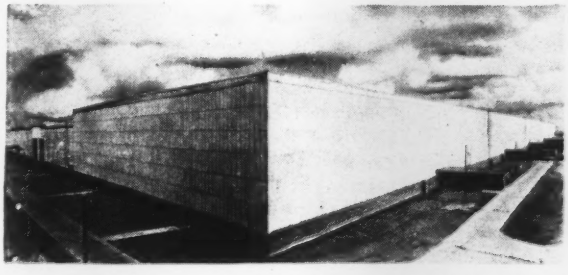
Lumbermen's Directory—(12-p. revised edition) Lists leading sawmill and remanufacturing plants, loggers, wood pipe, wood treating and prefabricating companies of Pacific Northwest. It details equipment used by each company, species of lumber offered, and products manufactured.—*West Coast Lumbermen's Association, 1410 S. W. Morrison St., Portland 5, Ore.*

Asphalt Pavements—(20-p. booklet) Furnishes detailed descriptions of types of asphalt paving in which asphalt and aggregate are mixed in plant. It covers proper procedure and materials to be used in construction of sheet asphalt, sand asphalt and the various types of

CORRUGATED TRANSITE* ... as modern as tomorrow

*Transite is a registered Johns-Manville trade mark

From smart shops on Main Street to gigantic "shops" of industry, Corrugated Transite is being used to streamline construction and reduce costs. Transite sheets can't rot . . . can't rust . . . can't burn



The corrugations in Transite increase the unusual strength of the asbestos-cement sheets—thus allow minimum framing. But the corrugations also serve as an important element of design in modern construction.

• The surprising news about Johns-Manville Corrugated Transite is not the fact that it is fireproof and weatherproof . . . or that it needs no preservatives, and practically no upkeep. Those and other advantages have already become widely appreciated through the years.

But look at the striking lines of the store front above . . . and the attractive, streamlined simplicity of the industrial giant shown at left. In both cases, versatile Transite provides *attractiveness* as well as utility. Yes, architects, engineers, and builders are discovering that Corrugated Transite lends itself effectively to modern design.

Use it on roofs or sidewalls . . . on both new or remodeled structures. Transite sheets are easily applied . . . cover large areas quickly because of their size . . . and can be completely salvaged when alterations are necessary.

Send for new brochure. Johns-Manville, Box 290, N. Y. 16, N. Y.

• • •

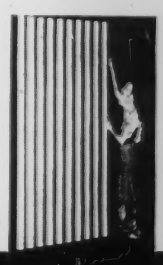
Because of unprecedented demand, there may be times when we cannot make immediate delivery. Please anticipate your needs.

EASY TO BOLT TO STEEL

EASY TO SAW

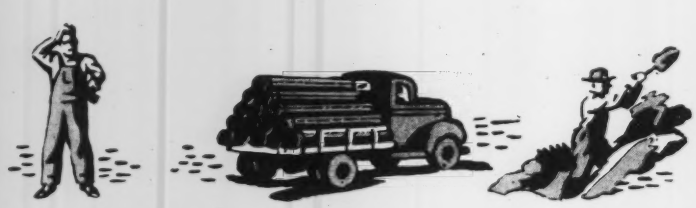
EASY TO DRILL

EASY TO NAIL TO WOOD

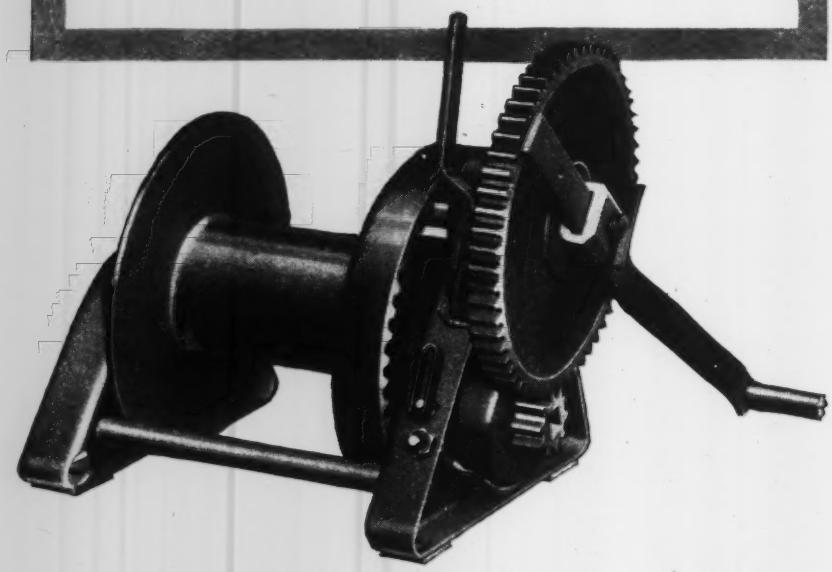


Johns-Manville *Asbestos* **CORRUGATED TRANSITE**

HOW WOULD YOU DO IT?



Can one man, with no power equipment . . . | . . . unload this heavy, bulky cast iron pipe . . . | . . . and place it in a deep trench?



The job's a cinch . . . . with HANDIWINCH

IT'S THE "little things" that bleed the profit out of any job, if they aren't handled efficiently. When you're lifting or pulling or moving loads up to 10,000 lbs., just plain "muscle power" is always slow and costly and often inadequate . . . yet heavy motorized hoists are far too expensive.

In such situations, the American Hoist HANDIWINCH is saving thousands of dollars for thousands of users daily. HANDIWINCH is *all steel* . . . built with many "big hoist" features. One man carries it, sets it up anywhere. It weighs 95 lbs., costs $75 f.o.b. your distributor. Write for folder HW-15, giving setup suggestions and full details on HANDIWINCH uses.

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LOCOMOTIVE CRANES • HOISTS • DITCHERS • DERRICKS • CANE CRANES • BLOCKS AND SHEAVES
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hot and cold-laid asphaltic concrete paving.—*Texas Co., Asphalt Sales Department, 135 E. 42nd St., New York 17, N. Y.*

Building with Wood—(40-p. pictorial booklet) Presents wide range of light and heavy frame wood structures employing Teco connector system of construction, Lamella construction, and glued laminated construction—*Timber Engineering Co., 1319 18 St., N. W., Washington 16, D. C.*

Protective Coating—(4-p. pamphlet) Gives details of and uses for Kopper-Bituplastic, new plastic protective coating that waterproofs and vapor seals any wall surface of metal, masonry or concrete. — *Wailes Dove-Hermiston Corp., Westfield, N. J.*

Vapor Steam Cleaning Machine—(4-p. folder) Describes new Model No. 46B for cleaning trucks, buses, automobiles, road and construction machinery, railroad, marine and general industrial equipment.—*White Engineering & Mfg. Co., Inc., 66 W. Passaic St., Rochelle Park, N. J.*

Trucks—(Free magazine) *Job-Rater* will provide factual and diversified information for truck owners and operators about trucks and their application and will deal with cost-reducing truck operations, economical truck maintenance, and efficient truck service. Send name for mailing list to—*Dodge Division, Chrysler Corp., Detroit 31, Mich.*

Conveyor Belts—(4-p. catalog section) Features guide on the selection of grades needed for specific belt services and gives details of each of its brands and special construction available in various belts.—*B. F. Goodrich Co., Akron, Ohio.*

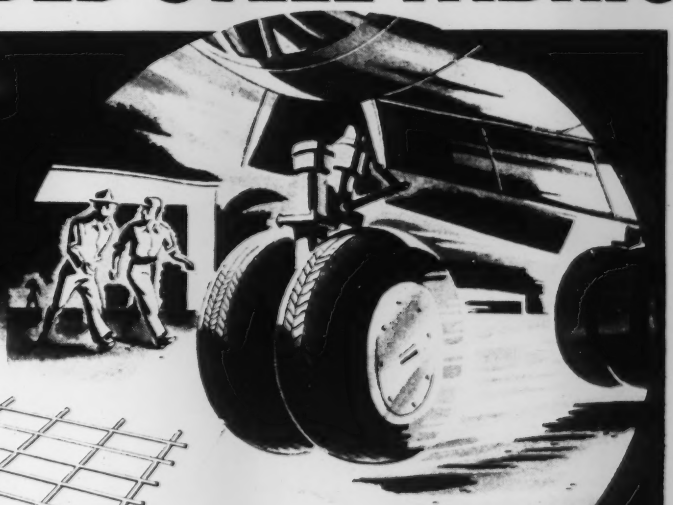
Welders—(Technical bulletin) Describes new line of standard pedestal spot welders with complete specifications, drawings, and detail as well as general photographs. — *Progressive Welder Co., 3050 E. Outer Drive, Detroit 12, Mich.*

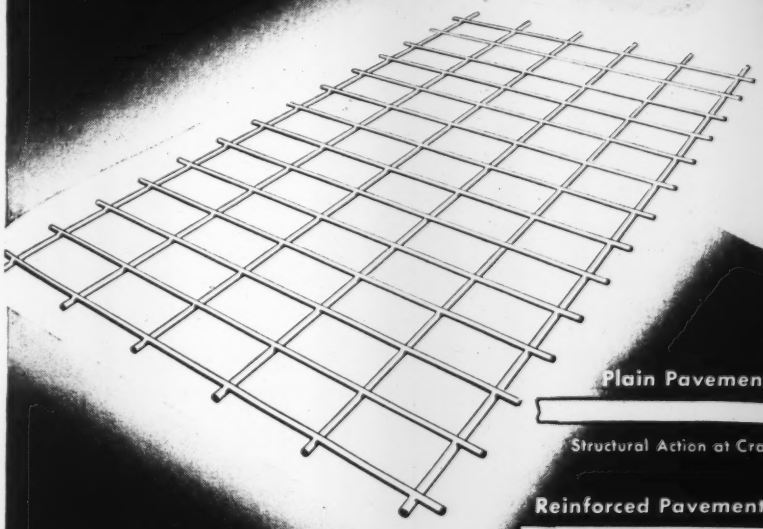
Vibrators and Grinders—(32-p. catalog) Contains up-to-date information on vibration of concrete, together with illustrations and complete description of new vibrator machines in Wyco line, including new jackshaft double V-belt drive units.—*Wyzenbeek & Staff, Inc., 838 W. Hubbard St., Chicago 22, Ill.*

Tank Jacks—(Engineering data bulletin) Includes complete specification charts, selection guide data and price listings on jacks for supporting and leveling tanks.—*Templeton, Kenly & Co., 1020 S. Central Ave., Chicago 44, Ill.*

TRUSCON WELDED STEEL FABRIC

Equalizes Load Stress and Helps Maintain High Pavement Efficiency





Plain Pavement (W) Open Crack

Structural Action at Crack in Plain, Non-Reinforced Pavement

Note that as heavy wheel load approaches crack in plain pavement, slab end carries entire load weight with no assistance from non-loaded slabs.

Reinforced Pavement (W) Closed Crack

Structural Action at Crack in Truscon Welded Steel Fabric-Reinforced Pavement

As wheel load approaches closed crack in Truscon Welded SteelFabric reinforced pavement, aggregate interlock renders the crack-joint shear resistant, and *both* slab ends, instead of one, carry the load.

● The tremendous landing impact of giant aircraft is no greater than that to which almost every square foot of your highways is subjected each day. The use of Truscon Welded Steel Fabric for reinforcement is highly desirable. Authoritative and official loading tests prove that cracks in reinforced concrete pavements consistently average a load transfer of about 48% at all seasons of the year. This value represents practically 100% shear-resisting capacity, since a load transfer of 50% is the absolute maximum that could occur theoretically under any conditions.

Cracking in concrete pavements cannot be eliminated entirely, but experience has proved that when the pavement slab is reinforced with Welded Steel Fabric between joints, the formation of wide cracks is prevented. The reinforcing holds the aggregate of the fractured slabs in close contact and enables the slab to function as a unit rather than as individual parts.

You can be sure that Truscon Welded Steel Fabric Reinforcement, and associated Truscon steel roadbuilding products, will build better, lower-cost roads for the communities you serve, and greater prestige for you.

TRUSCON STEEL COMPANY
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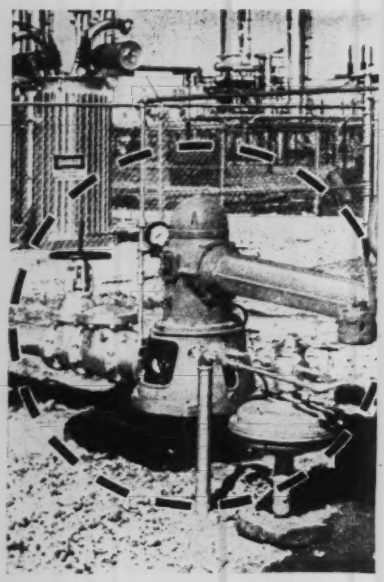
Manufacturers of a Complete Line of Steel Windows and Mechanical Operators . . . Steel Joists . . . Metal Lath . . . Steeldeck Roofs . . . Reinforcing Steel . . . Industrial and Hangar Steel Doors . . . Bank Vault Reinforcing . . . Radio Towers . . . Bridge Floors.



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OF THIS PICTURE

To you, the reader, the above picture is just one of hundreds of Layne Well Water Systems that are now serving oil fields, refineries and pumping stations. But to us, it is a symbol of approval by one of the world's largest and most important industries. Furthermore, this picture serves to symbolize a record of nearly seventy years of successfully matching the highest quality materials with honest craftsmanship.

Yes, we are proud of this picture—and several thousand others of Layne Well Water Systems now serving Municipalities, Railroads, Factories, Chemical Works, Packing Plants, Paper Mills and Air Conditioning and Irrigation projects.

We know the penalty of leadership in our chosen field, the flattery of imitation and the real satisfaction of serving the same customers for generations and generations. Our equipment and services are consistently higher in quality than the buyer demands—more dependable than we promise—and longer lasting than the owner expects.

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News of the Week

(*Continued from page 61*)

The President requests reduced building costs

In his July 21 economic report to Congress, President Truman asked for adjustment of construction costs, especially those on housing work. He also renewed his plea for comprehensive housing legislature.

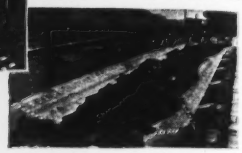
The President stated that he is disappointed that only 750,000 housing units will be completed this year. This total compares to the 1,000,000-unit goal established months ago by the housing expediter and his staff.

In discussing housing costs the President said, "Fundamental adjustments must be made in housing costs. Up to now, the housing shortage has been so serious that buyers have been available at almost any price. But already, high prices are preventing the bulk of new housing construction from serving those who need it most and are preventing the total volume of new housing from reaching desired levels. If not reduced, these prices will lead inevitably to a decline in housing construction when the limited market made up of those who can buy in spite of cost has served. Nowhere are cost reductions more important to the whole economy than in the case of construction."

Encouragement that costs can be reduced was offered by Mr. Truman. He stated, "But there is widespread agreement that costs can be lowered through the joint efforts of material suppliers, builders, and workers. Producers of materials, construction labor, and builders all have a vital stake in this. If they achieve a substantial cut in building prices, they can look forward to a long period of high activity based upon vast needs."

The President's plea for permanent housing legislation was as follows: "The provision of publicly financed housing for low-income families, the facilitation of land acquisition in urban areas, the stimulation of privately financed rental housing through yield insurance and other measures, and the initiation of a broad rural housing program, are all indispensable elements in providing healthful and cheerful living conditions for all the American people at costs within their means. From the purely economic viewpoint, many have repeatedly emphasized the dangers to our economy if the housing industry is not stabilized at high levels of production. Even assuming the necessary

KEEP YOUR CONVEYOR BELTS GOING



FLEXCO H D RIP PLATES are used in repairing rips and patching conveyor belts. Their use saves expensive replacements and extended shutdowns.

FLEXCO H D BELT FASTENERS make a strong, tight butt joint with long life. Recessed plates embed in belt, compress belt ends and prevent ply separation. Six sizes in steel and alloys.

● **Avoid shutdowns and lengthen the life of your conveyor belts and bucket elevator belts by using Flexco belt fasteners. Thousands of companies have stepped up the performance of conveyor lines and cut costs by using Flexco methods.**

Bulletin F-100 shows exactly how to make tight butt joints in conveyor belts with Flexco. Also illustrates step by step the latest practice in repairing rips and putting in patches.

Write for your copy.

FLEXIBLE STEEL LACING CO.
4656 W. Lexington St., Chicago

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Cleveland 15, Ohio

LOWERING 5-TON SECTION. Pipe was made to meet ASTM-C 75-41 specifications for 3000-lb. concrete.

LAID IN OPEN CUT. Most of line was laid in open cut 20 to 30 feet deep, on 6-in. concrete cradle.

84 in. CONCRETE PIPE

in 5-ton sections assures permanence of new Normal, Ill., relief sewer

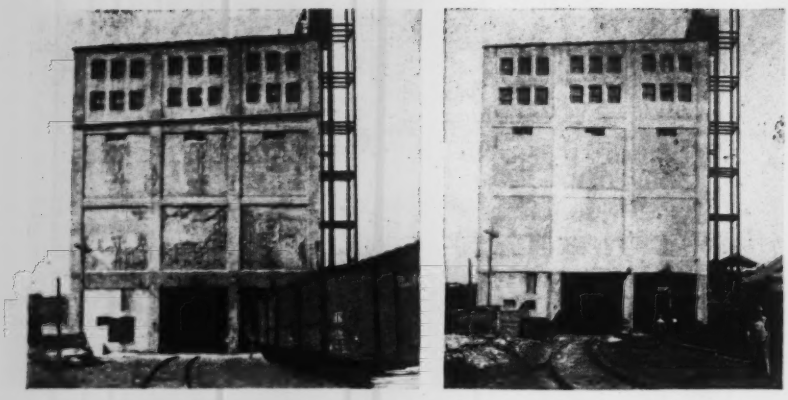
EVERY time the town branch of Sugar Creek went on a spring rampage, Normal, Illinois, used to have a flood. Businessmen grew tired of having their basements full of Sugar Creek. Something has been done about it. Normal now has a relief sewer seven feet in diameter—big enough to take the overflow from one branch of Sugar Creek and ease it across town, away from the business district, to another branch of Sugar Creek where the surplus water can do no harm.

J. J. Woltmann, Consulting Engineer of Bloomington, Ill., designed the new 3500-foot Cypress Alley Sewer. He specified 84-in. CONCRETE PIPE—for strength to resist impact and sustain heavy burdens—for maximum hydraulic capacity—for minimum leakage and infiltration. Most of the line was laid in an open cut at depths of 20 to 30 feet, and the pipe rests on a 6-in. cast-in-place concrete cradle. Cassidy Construction Company of Melrose Park, Ill., handled construction.

PORTLAND CEMENT ASSOCIATION

Dept. A8a-170, 33 W. Grand Ave., Chicago 10, Ill.

A national organization to improve and extend the uses of concrete . . . through scientific research and engineering field work



"GUNITE" RESTORES CONCRETE BUILDING

The before and after photos show the breaker building at Cayuga Rock Salt Company, Myers, N. Y. This concrete building was badly disintegrated due to salt action on the reinforcing steel. Last year we contracted the complete reintegration of the walls and roof of this building.

The disintegrated areas of the walls were chipped and the entire surface washed and sandblasted. Reinforcing mesh was placed over the entire area and 1½" minimum "GUNITE" applied, and brush finished. The roof slab was similarly repaired with "GUNITE," both top and bottom. Sufficient old concrete was chipped away to prevent increasing the dead load of the roof slab.

"GUNITE" is impervious, thus it will not permit the infiltration of salt brine to attack the reinforcement. Its use as armor against sea water and conditions such as above described is very common, and its success remarkable.

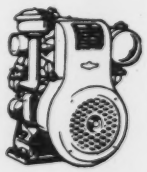
Write for our free 72-page descriptive bulletin A-2300.

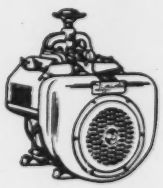
CEMENT GUN COMPANY

"GUNITE" CONTRACTORS

GENERAL OFFICES—ALLENTOWN, PENNA., U.S.A.

The REAL MEASURE of ENGINE VALUE is "H. P. HOURS" of POWER SERVICE





Wisconsin Engines are available in a complete range of types and sizes (all 4-cycle) from 2 to 30 hp.

It isn't the original H.P. rating of an engine that counts but rather, the number of *H.P. Hours* of power service it will deliver during its lifetime. This, in the final analysis, is the real measure of *engine value.*

Wisconsin Air-Cooled Engines deliver the most H.P. Hours because they are designed and built for rugged, heavy-duty service. For example: every Wisconsin Engine, from the smallest to the largest, runs on Timken tapered roller bearings at both ends of the crankshaft to take up end-thrust and provide the best protection against bearing failure . . . at the same time assuring a smooth-running engine. This is just one typical detail that stands back of "Most H.P. Hours" of on-the-job power service.

You can't go wrong if you specify "Wisconsin Air-Cooled Engines" to meet your power requirements, within a 2 to 30 hp. power range.

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price reductions, no such goal can possibly be achieved or maintained without a home-building program for all income groups in all parts of the country, urban and rural."

Pennsylvania begins clearing up Schuylkill

Pennsylvania has started work on the $15,000,000 project to clean up the Schuylkill River. Four engineering firms designated by the state to clean up the area covering 1,916 square miles entirely within Pennsylvania's boundaries are beginning the work at the Auburn Dam near Port Clinton, 104 miles upstream from Philadelphia.

The Department of Forests and Waters said the work will require at least four years and eventually will cost some $15,000,000. The 1945-47 state legislature appropriated $10,000,000 for the work and a final $5,000,000 appropriation is to be authorized in 1949.

Engineering firms chosen for the work are Day and Zimmerman Inc.; Albright and Friel, Inc., Justin and Courtney and Harris-Dechant Associates. Capt. Federick H. Dechant, naval veteran of two world wars, has been chosen chairman of the engineering board set up by the four firms. Captain Dechant is associated with Admiral Frederick R. Harris, (retired) with offices in the Fidelity-Philadelphia Building, Philadelphia.

The state will carry the work as far as Norristown, Pa. from that point to the mouth of the Schuylkill River, a distance of some 25 miles, the work will be done by the United States Army Engineers.

Federal participation begins when the state's work is 50 percent completed. The present estimate of federal costs is $12.895.000.

The state's program includes the construction of 30 disposal areas where thousands of tons of river-dredged silt will be piled behind revetments. Five new dams are to be built in addition to seven dams now in use. The state will own the coal deposited in the disposal areas and will add to its revenue by selling it.

In addition 35 collieries will construct desilting systems. Ten other small breakers found to be polluting tributaries of the Schuylkill River also have been directed to install desilting basins.

Meanwhile the Department of Forests and Waters has planned a campaign to prevent soil erosion along the river. The Department has 47,000,000 evergreen seedlings which are to be planted in blighted areas. Last year 7,000,000 were planted.